PLANT LIFE

VOLUMES 31-35
1975-1979, incl.

EDITED BY

HAMILTON P. TRAUB
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THE AMERICAN PLANT LIFE SOCIETY
Box 150, La Jolla, California

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PLANT LIFE

MARYLLIS 1975
EAR BOOK

Sprekanthus cagei Traub, a bigeneric hybrid of Sprekelia formosissima (L.) Herb. ♀ and Habranthus robustus Herb. ♂, flower color scarlet with tint of lavender, produced by Dr. John Cage of Los Altos, California [see PLANT LIFE 25: 77-78. 1969].

Goff

THE AMERICAN PLANT LIFE SOCIETY

THE AMERICAN PLANT LIFE SOCIETY is organized for the "increase and diffusion of knowledge concerning plant life," and to carry out its objectives the main emphasis is placed on the publication of PLANT LIFE, the periodical devoted to plant life, incl. HERBERTIA, the yearbook devoted exclusively to the amaryllids, sponsored by the affiliated AMERICAN AMARYLLIS SOCIETY. The publications are international in scope. All paid up members are privileged to receive the current issues of PLANT LIFE, incl. HERBERTIA, THE AMARYLLIS YEARBOOK.

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The American Plant Life Society
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PLANT LIFE

VOLUME 31

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HAMILTON P. TRAUB

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The cover design, by Prof. Penrith B. Goff, represents the bigeneric hybrid, **Sprekanthus cagei** Traub, a cross between species of **Sprekelia** and **Habranthus.**

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GENERAL AMARYLLID EDITION

PLANT LIFE, VOLUME 31, NOS. 2—4, INCL., 1975

GENERAL EDITION

ILLUSTRATIONS

PLANT LIFE LIBRARY—continued from page 112.

THE SEEDLIST HANDBOOK, by Bernard E. Harkness. Kashong Publications, Box 90, Bellona, New York 14415. 1974. Pp. 187. Paper, $3.00.—The purpose of this book is to furnish a guide to seed selection from the seed lists of the American Rock Garden Society, the Alpine Garden Society, and the Scottish Rock Garden Club. The literature references are keyed so that at least one source for more information is indicated for each of the plants listed alphabetically from **Acer** to **Veronica** species. Highly recommended to all interested gardeners.

REDIDUE REVIEWS: RESIDUES OF PESTICIDES AND OTHER CONTAMINANTS IN THE TOTAL ENVIRONMENT, edited by Francis A. Gunther & Jane Davies Gunther. Vol. 49 (1973, pp. vii + 158); Vol. 51 (1974, pp. ix + 189); and Vol. 53 (1974, pp. ix + 157). Springer-Verlag New York, 175 5th Av., New York City 10010. $18.50 per volume.—In these three volumes contributions on the residues or other contaminants are published in the order in which they are received, and the mass of information is indispensable to all who are concerned with problems caused by the use of pesticides, particularly those engaged in the production, storage, marketing, regulation and consumption of foodstuffs.

BIOLOGICAL CONTROL OF PLANT PATHOGENS, by Kenneth F. Baker and R. James Cook. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1974. Pp. xiv + 433. Illus. $12.50.—In this outstanding new text on the biological control of pathogens, the authors discuss the control of plant pathogens by the host or other organisms through environmental manipulation—they organize the available knowledge into a thorough treatment of the principles of biological control of plant pathogens, and they suggest practical ways of applying those principles. They present biological control as one part of an integrated disease-control program, along with cultivation practices, pathogen-free propagules, soil treatment, sanitation, host resistance and mild chemicals. Selective soil treatment and mass transfer of antagonists from a suppressive to a conducive soil are emphasized. Highly recommended to those working in this research area, and to those interested in applying this knowledge in the control of plant pathogens in agriculture, horticulture and forestry.

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CORRIGENDA

PLANT LIFE, VOLUME 30, 1974

Page 29, paragraph 2, for "UP", read "UB."
Page 33, paragraph 3, for "Vallecite", read "Vallecito".
Page 35, paragraph 2, for "compressess", read "compressed".
Page 36, paragraph 1, for "marketedly", read "markedly".
Page 37, paragraph 7, for "lunulate", read "lunulatae".
Page 38, paragraph 9, for "Chukuisaca", read "Chuquisaca".
Page 43, paragraph 7, for "balde", read "valde".
Page 43, paragraph 8, for "auranthiacus", read "aurantiacus".
Page 44, paragraph 2, for "exerophytic", read "xerophytic".
Page 44, paragraph 3, for "Inter Londres and . . .." read "Inter Londres et. . ."
Page 46, paragraph 1, for "board", read "broad".
Page 47, paragraph 2, for "*Oxalis machin*", read "*Oxalis macachin*".
Page 47, paragraph 2, for '*Nothoscordum balacnese*", read "*Nothoscordum balaenense*".
Page 47, paragraph 3, for "Pruguriae", read "Uruguariae".
Page 51, paragraph 8, for "Argentinan", read "Argentinian".
Page 57, paragraph 1, for "*Hippeastrum gladiolodes*", read "*Hippeastrum gladioloides*".
Page 58, subheading 1, for "subspecies", read "forma".
Page 59, paragraph 1, for "bublets", read "bulblets".
Page 61, paragraph 3, for "Folad", read "Folia ad. . ."
Page 62, caption of Fig. 19 for (X. 0. 02), read "(X 0.3-0.4)".
Page 63, paragraph 9, for "illustradition", read "illustration".
Page 65, paragraph 2, for "de cumbens", read "decumbens".
Page 66, caption of Fig. 20, for "Marel", read "Morel".
Page 72, paragraph 6, for "Mentham & Hooker f. (1880, p. 723)", read "Bentham & Hooker f. (1883, p. 723)".
Page 73, paragraph 1, for "which occurs", read "that occur".
Page 73, paragraph 3, for "porthern", read "northern".
Page 73, paragraph 6, for "*Castellanoa martinata*", read "*Castellanoa marginata*".
Page 76, paragraph 5, for "*Stenomesson blareosum*", read "*Stenomesson glareosum*".
Page 77, paragraph 3, for "(type HUT 6054)", read "(type TRP 6054)".
Page 78, caption of Fig. 24 for "Photo by Pierfelice Ravenna", read "Drawing by Pierfelice Ravenna".
Page 90, Figure 27 is up-side-down. As the Figure now appears, the caption should read: from left to right, *Upper*, *Amaryllis* clone 'Senorita'; *A. evansiae* x *A. starkii; A. iquazuana*, and *A. belladonna minor. lower, A. starkii; A. evansiae; Amaryllis* clones 'Ludwig's Dazzler' and 'Superba'.

PLANT LIFE, VOL. 31, NO. 1, January, 1975

AMARYLLIS
YEAR BOOK
1975

Year Book of

The American Amaryllis Society

42nd Issue

General Amaryllid Edition

EDITED BY

Hamilton P. Traub

Thomas W. Whitaker

Harold N. Moldenke

THE AMERICAN PLANT LIFE SOCIETY

Box 150, La Jolla, California 92037

THE AMERICAN PLANT LIFE SOCIETY

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PREFACE

Once again we are indebted to Prof. Penrith B. Goff of Wayne State University, Detroit, Michigan, for the excellent cover design featuring *Sprekanthus cagei* Traub, a bi-generic hybrid between *Sprekelia formosissima superba* ♀ and *Habranthus robustus*, ♂ reported by Dr. Cage in the 1969 Amaryllis Year Book (Plant Life 1969, pp. 77-78).

This 42nd annual edition of HERBERTIA, THE AMARYLLIS YEAR BOOK, is dedicated to Dr. John M. Cage of Yuba City, California, for his outstanding contribution toward the achievement of true breeding large-flowered hybrid *Amaryllis* lines. The need for such breeding lines has been realized for a long time, but Dr. Cage is the first to provide some of these. His work makes it feasible to grow large-flowered *Amaryllis* hybrids which come true from seeds making it possible to propagate these rapidly. The alternatives now usually used is to reproduce clones by natural offsets or by bulb cuttage, which are slower and more expensive methods for the increase of desirable clones. Dr. Cage has also made outstanding contributions towards efficient culture, disease and pest control, and the storage of Amaryllis bulbs. For his important contributions to science he has received the WILLIAM HERBERT MEDAL of the AMERICAN AMARYLLIS SOCIETY. In the present issue of the AMARYLLIS YEAR BOOK, Dr. Cage contributes a charming autobiography, and articles on the breeding and culture of Amaryllis, and on the flowering of dry, dormant Amaryllis bulbs. For these valuable contributions we are all grateful.

Dr. A. Graham Sparkes of Sussex, England, contributes a charming biography of the late great gardener, Walter Fleming, including a photograph of him working in his garden which is really a work of art, reminiscent of the work of the great masters.

Other articles on Amaryllis in the present edition are contributed by Dr. Cesar Vargas on Peruvian Amaryllids; by Dr. William D. Bell, on the Korsakoff Amaryllis hybrids, by John W. Hirschman, on breeding Amaryllis; and by Drs. Nowicki and O'Rourke, on the elimination of mosaic virus from Amaryllis.

Marvin Ellenbecker reports on the world-wide geographical distribution of the Amaryllidaceae; Sr. Ravenna favors us with his usual outstanding contribution on Latin American Amaryllids; and Dr. Flory reports on the chromosome numbers of several southeastern United States and Mexican *Hymenocallis* species.

Mrs. Marcia Clint Wilson favors us with a world wide report on the Zephyrantheae, and Mr. Forbes reports on his collection of Zephyrantheae in far off Australia. Mr. Tisch writes about his experiments with the increase of the Zephyrantheae by bulb cuttage; and Mr. Zuidgeest favors us with a preliminary report on color classes of Nerines in his collection.

Dr. William D. Bell speaks up for the neglected Bomareas; and

Miss Josephine Henry writes about Agaves cultivated in Pennsylvania.

There are reports on the Amaryllis shows in the Greater Houston (Texas), New Orleans (Louisiana), Mobile (Alabama), and the greater Los Angeles (California) areas, and other contributions as shown in the Table of Contents.

Contributors to the 1976 issue of the AMARYLLIS YEAR BOOK are requested to send their articles by August 1, 1975, in order to insure earlier publication of this edition. Unless articles are received on time, publication will again be delayed to June or July or even later as with some issues in the past. Your cooperation toward earlier publication will be greatly appreciated. *Those having color slides or transparencies which they wish to use as the basis of illustrations, are requested to have black-and-white prints made, and to submit these with their articles.*

December 15, 1974,
2678 Prestwick Court,
La Jolla, California 92037

Hamilton P. Traub
Thomas W. Whitaker
Harold N. Moldenke

PLANT LIFE LIBRARY—continued from page v.

FLOWERS AND PLANTS: INTERNATIONAL LEXICON WITH BIOGRAPHICAL NOTES, by Robert Shosteck. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York City 10022. 1974. Pp. xx + 329. $9.95.—This is a botanical, etymological, biographical and historical guide to 1150 varieties of the flora of the world, arranged alphabetically from **Abelia** through **Zinnia,** preceded by an informative introduction. A glossary, bibliography and index complete the volume.

A CONCRETE LOOK AT NATURE: CENTRAL PARK (AND OTHER) GLIMPSES, by Eugene Kinkhead. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York City 10022. 1974. Pp. xii + 242. $8.95.—This is a look at nature through the medium of the great Central Park of New York City, as observed by an ardent naturalist. The first four chapters are concerned with the animals that inhabit the park—birds, squirrels, etc., and also the soil and water life. The remaining chapters deal with various aspects of nature, meteorites, heavy rainfall, the largest **Ailanthus** tree, the lady who defends beavers, biluminescence, and so on. Highly recommended.

A GUIDE TO NATURAL COSMETICS, by Connie Krochmal. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York City 10022. 1973. Pp. vi + 227. $8.95.—This is a practical guide to the making of cosmetics from plants and other natural ingredients, with illustrations of some of the common plants mentioned. An appendix describes the raw material and their composition, with a list of sources for the raw materials. An index completes the volume.

PLANT CONSCIOUSNESS; PLANT CARE, by Shirley Ross. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York City 10022. 1973. Pp. x + 170. Illus., $7.95.—This book explores the relationship of plants to man by examining both the historical and mythical context and the modern scientific developments. Part One is concerned with the controversial subject of plant consciousness. Part Two is devoted to plant care.

PLANT LIFE LIBRARY—continued on page 5.

DEDICATED TO

JOHN MARTIN CAGE

PLANT LIFE LIBRARY—continued from page 4.

QUANTITATIVE AND DYNAMIC PLANT ECOLOGY, 2nd Edition, by Kenneth A. Kershaw. American Elsevier Publ. Co., 52 Vanderbilt Av., New York City 10017. 1974. Pp. x + 308. Illus. Paper, $8.50.—Since the publication in 1964 of the first edition, there has been much progress in the fields of quantitative and dynamic ecology which necessitated the production of this revised edition. The subject matter is developed under the following headings—Description of vegetation; sampling methods; plant succession and climax; cyclic and vegetational change; casual factor of positive and negative association between species; plant population dynamics; the detection of non-randomness; casual factors of pattern; classification and ordination methods; digital computers and ecology; and computer simulation studies. Very highly recommended to all interested in plant ecology.

VIRUSES AND INVERTEBRATES, edited by A. J. Gibbs. American Elsevier Publ. Co., 52 Vanderbilt Av., New York City 10017. 1973. Pp. xiii + 673. Illus. $60.00.—The objective of this symposium is to cut across traditional research barriers in order to facilitate progress in the field of virological research: (1) those who study viruses of invertebrates, and (2) plant, and (3) mammal virologists who study vector-borne viruses. The first section is concerned with historical accounts; the second, deals with viruses involved with invertebrates; and the classification and biology of various invertebrates involved with viruses; the third is given over to general topics; the fourth, is concerned with the ecology of viruses; and the final section deals with the control of viruses; and also the control of certain invertebrates with viruses. Very highly recommended to all who are interested in viruses.

BOTANY, by Michael Neushul. John Wiley & Sons (Hamilton Publ. Co. Div.) 605 3rd Av., New York City 10016. 1974. Pp. xviii + 532. Illus.—This generously illustrated book on plant science is divided into four sections. Part I deals with type history of classification; the plant cell; cell chemistry; genetic code; cellular energy; diversity and the plant kingdom. Part II is concerned with procaryotes—bacteria & blue green algae; and eucaryotes—algae, fungi, liverworts and mosses. Part III deals with land plants, the rest of the eucaryotes—ferns and seed plants; conifers and flowering plants. Part IV is concerned with growth and development; environment and plant response; ecosystems and plants and man. A special color section deals with major crop plants. Very highly recommended to all interested in botany.

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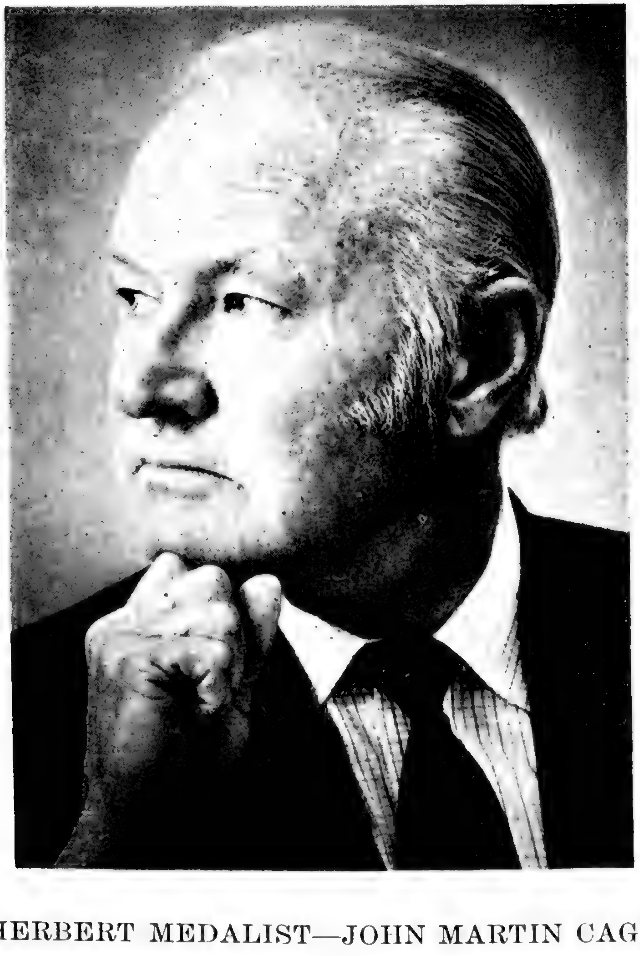

HERBERT MEDALIST—JOHN MARTIN CAGE

JOHN MARTIN CAGE

AN AUTOBIOGRAPHY

I was born on December 23, 1909, in Stephenville, Texas, and had the advantage of growing up in this small community in the center of that great state. Until he lost everything in the Great Depression, my father, the head of a small, old family bank, had all the money we needed, and I had much freedom and encouragement to play, to fight, to think, to read, to study music, to dream. I would not know how to select better parents—a father who quietly assumed as a fact that my brother and sister and I would develop a good life, and a mother, Ivy Lenore, who never let any hardship curtail her free spirit, her protective love, her beauty, or even her frivolity.

Guglielmo Marconi would not be envious of the fact that I built the first radio set in Erath County, while I was in high school. After I spent two years in a small local college, my interest in radio led to a B.S. degree in electrical engineering from Iowa State University, and I was lucky to spend seven years during the depression doing vacuum tube research in the laboratories of the General Electric Company. I continued graduate studies during this time and was granted an honorary E.E. degree by Iowa State for my research, patents, and scientific papers. Recipients of that degree were usually addressed as "Doctor" in those days, but abuse on the part of some schools made me feel uncomfortable about the title, and I have tried always to avoid its use.

This avoidance was not made easier when I later taught graduate courses in electronics at Colorado University and Purdue University. Between positions at these two schools, World War II sent me back into industry and some business ventures and consulting. I wrote a college textbook in electronics and have recently co-authored a technical reference book, "Electronic Measurements and Instrumentation."

From 1956 until my retirement in 1974, I held various positions in research and general management in the Hewlett-Packard Company, which manufactures a very extensive line of electronic instruments and small computers. In 1956 I was Chairman of the Board of the National Electronics Conference, and I am a member of several technical and scientific societies.

However, it was in 1938 in Boulder, Colorado, after winning some ribbons at the County Fair for my vegetables, that I bought two dime-store amaryllis bulbs. They bloomed, and out of curiosity I crossed them and grew the seeds to maturity. During this time I began to study botany and horticulture as a hobby. My study of inbreeding started almost immediately, and my various inbred strains and the records thereof were hauled with much difficulty from one residence to another.

After meeting and corresponding with some wonderful people like Wyndham Hayward, Cecil Houdyshel and our revered editor, I began to study the work of other amaryllis breeders in America seriously. After two or three years, the following became apparent to me:

1. Mainly, the work was simply a splendid hobby for amateurs, with limited regard for the principles of genetics.

2. Some very interesting results with much potential were produced, but nearly always the plants and the records of their parentage were lost as the breeders grew older. There was little continuity of objective.

3. The Dutch breeders did have continuity from generation to generation, and by growing thousands of seedlings every year from crosses of their best bulbs, they developed beautiful, fairly uniform strains through selection.

Fig. 2. John M. and Mildred Cage in their greenhouse devoted to Amaryllis breeding.

It was obvious that I could not compete with Dutch breeders at their own game, and so I searched for a project that I could handle with my limited time and facilities. The inspiration came from reading about the wonderful development of F:1 hybrid corn, and I later met some of the leaders of that work at Purdue University. I decided I would inbreed selected *Amaryllis* hybrids, blend with some species *Amaryllis,* and inbreed some more, to see how much uniformity of desired characteristics could be obtained. It quickly became obvious that heterosis, or hybrid vigor, often occurred when inbred strains of different parentage were crossed.

Now I have several red inbred strains that produce a high percentage of exhibition-type 5a plants when properly crossed. I also have white, dotted-and-flushed, orange pastel, and miniature solid red strains—all inbred to the point of good uniformity and breeding value.

My hope is that the projects will have been taken over by a competent breeder by the time this is published.

I have one spirited, gifted son by my first wife, who passed away some years ago. I also have my wonderful Mildred and four great step-offspring (they certainly are not children). Mildred quickly became friends with my *Amaryllis* lines and selected clones, and she has been of priceless assistance in our plant work and in every other way. Marriage in the fifties for love is highly recommended.

My real problem here is to express my gratitude to, and affection for, so many friends in the world of plants. They are so numerous that I really should name none, but if the list included none but Len and Corabelle Doran, Quinn Buck, Gladys Williams, and Hamilton Traub, it would be, as Omar said, "paradise enow." Besides, I count each member of the Southern California Hemerocallis and Amaryllis Society equally as my good friend.

WALTER FLEMING—GARDENER EXTRAORDINARY

A. Graham Sparkes, *Churchfield, Station Road, East Preston, Sussex, England*

Walter Fleming was born on the 16th July 1882 at Moffatt in the County of Dumfries, Scotland. His father, Alexander, was a shepherd so it was perhaps not surprising that Walter had an instinctive and abiding love and respect for all things in nature. This stayed with him until his death on the 27th October 1965 at the age of 83 years.

He was a gardener in the widest sense of the word and it was in 1915 that recognition of his abilities as a gardener came when he was awarded the Gold Medal of the Scottish Horticultural Association for a paper on the Cultivation of the Potato. He served his country with the Royal Artillery from 1914-1918.

In 1920 he was appointed Head Gardener by Captain McEachan at Galloway House, Garlieston in Wigontownshire, Scotland, where he remained for eight years and won the respect and acclaim of horticulturalists over a wide area. It was at this time that he married his wife, Jean, who was also a Scot. The only child born to them was a son who unfortunately died in infancy. Later a 17 year old niece came to stay with them in Sussex and was taken into the family permanently and was looked upon as a daughter.

In 1928 Colonel Stephenson R. Clarke appointed Walter Fleming as Head Gardener and together they planned and developed the gardens at Borde Hill, Sussex, where some sixteen gardeners were under the direction of the Head Gardener. Sir Ralph Clarke carried on the labour of love started by his father so that today Borde Hill Gardens are among the loveliest in Sussex and open to the public particularly when the rhododendrons are in full bloom, many of them developed and bred by Walter Fleming. Until his retirement he lived on the estate at East Lodge in order that he might be with his plants and tend them at all times.

During his period at Borde Hill and with the utmost encouragement and support of both Colonel and Sir Ralph Clarke, Walter Fleming emerged as a hybridist of repute whose experience, resourcefulness, ingenuity and skill were seen to the full in his association with the Borde Hill Camellias of which he bred many successful hybrids such as 'Donation' and 'Salutation'. 'Donation' proved to be outstanding and received from the Royal Horticultural Society a First Class Certificate in 1952 and in the same year an Award of Merit which was a great distinction. This was a cross between *C. saluensis* x *C. j. donckelarii* and thousands of plants throughout the world have resulted from this original plant (which is still flourishing at Borde Hill) which, as well as its qualities for hardiness and of being easily raised from cuttings, has the attraction of flowering at a very early age.

He is also remembered as being the originator of the *Alstroemeria* 'Walter Fleming' which was awarded an Award of Merit by the R.H.S. in June 1948. This is a cross between *A. violacea* x *A. aurantiaca*, the outer petals are a dull white suffused with purple while the inner petals are a deep yellow, heavily marked with maroon. This is still the major variety throughout European commercial horticulture for flower production. He showed frequently at the Society's shows where his exhibits were noteworthy for their excellence both of cultivation and presentation. He helped build up a collection of Nerines at Borde Hill, winning many awards for these flowers. One named after him was awarded a F.C.C. in 1959. It says much for his skill that his hybrids of various species are still widely used in the trade.

In recognition of his services to horticulture he was elected in 1953 an Associate of Honour of the Royal Horticultural Society and retired the following year in 1954 at the age of 72 years. This distinction is conferred on British persons who have rendered outstanding service to horticulture in the course of their employment. The roll of Associates of Honour may not exceed 100.

Even at this age, however, retirement was not acceptable and for a few years until his health began to fail he occupied himself with landscape gardening in the Lindfield area. This remarkable man was still tending his cottage garden up to a few weeks before his death. He is buried, along with his wife who survived him by five years, in the Ardingly Churchyard, which is an old church typical of the locality and in a beautiful Sussex country setting. Obituary notices appeared in local papers and many gardening journals. The following appeared in The Gardeners Chronicle at that time:-

"The many old friends of Walter Fleming will be grieved to learn of his passing away on October 27 at the age of 83 after a short illness. For almost 30 years he was Head Gardener at Borde Hill in Sussex where the creation of *Camellia williamsii* 'Donation' and *C.* 'Salutation' will remain as monuments to his and the late Col. Stephenson Clarke's gardening ability. Mr. Fleming was a quiet humble man with an unassuming manner that often cloaked the genius that was so obvious to those who knew him. His particular interests were of course

Fig. 3. Walter Fleming in his garden.

rhododendrons and trees and shrubs for which the gardens are famous but a plant bearing his name, *Alstroemeria* 'Walter Fleming' will remain as a living testimony to a gardener in the first rank. We convey our heartfelt sympathy to Mrs. Fleming for the loss of a gentle and kindly man."

Walter Fleming was physically a big man and immensely strong, but he was to all who knew him an extrenely modest, gentle and generous man. To his nephew by marriage in a rare and treasured moment he confided "As I work with my shrubs and plants, my trees and vegetables, I sometimes feel as if I touch God".—This was the measure of Walter Fleming, gardener extraordinary.

DR. JOHN HUTCHINSON, 1884-1972

We are sad to record the death of the eminent lineagicist, Dr. John Hutchinson who went to his reward, aged 88, September 2, 1972.

In connection with the *WILLIAM HERBERT MEDAL* award to him in 1939, a brief autobiography with portrait, was published in the 1939 *HERBERTIA*. In the same issue he also contributed an article on the Tribe *Gilliesicae* (Herbertia 6: 139-145. 1939).

A brief biography of Dr. Hutchinson by J. P. M. Brenan appears in *Kew Bulletin* 29(1): 1-5, plate 1. 1974. In addition, Carolyn M. K. Pope, in the same publication (*Kew Bulletin* 29(1): 5 14. 1974), contributes a complete bibliography of Dr. Hutchinson's contributions in the field of lineagics.—*Hamilton P. Traub.*

EDITOR'S MAIL BAG

Under date of June 14, 1974, Mrs. Sam Forbert, Hattiesburg, Miss., writes,—"The Hattiesburg (Miss.) Amaryllis Society mourns the passing of Mrs. J. W. (Sudie) Snowden, on April 16, 1974. She was a charter member of the local organization, (1956); a long member of the American Plant Life Society and its affiliate, the American Amaryllis Society (1956), and the National Amaryllis Judges Council (1957). Through her association with the organizations, she acquired a rich knowledge of her favorite flower. She generously shared seeds and seedlings with all interested persons. Sudie was indeed a shining star."

Under date of August 9, 1974, Dr. William D. Bell, Horticulturist, Fairchild Tropical Garden, 10901 Old Cutler Road, Miami, Florida 33156, writes,—"I now have *Amaryllis cybister* and *A. angustifolia* in sterile culture. When several plantlets have formed, I plan to treat these with colchicine in the manner the others were treated previously. Mrs. Korsakoff had *A. cybister* x Dutch, a showy plant pollinated with a tetraploid *cybister*. I suggest that one could easily have a new strain of 'spider' hybrids."

Amaryllid breeders will be interested in the new intergeneric cross between wheat (genus Triticum) and rye (genus Secale). This

w man made genus has been appropriately called *Triticale*. The ticle by Joseph H. Mulse and David Spurgeon reporting the history this breeding program up to the present its published in *Scientific nerican* of August 1974, pp. 72-80. The summary states, "This brid combines the high yield of one of its parents (wheat) with the ggedness of the other (rye). It now seems certain that it will comte successfully with the traditional cereal grains."

We have received the sad news that Mr. David E. Wilson, husband Mrs. Marcia Clint Wilson of Galveston, Texas, passed away Saturday, ugust 6, 1974. He had been on medication for an undiagnosed ailent. An acute allergy due to medication made him desperately sick r a few days and resulted in his death. Mrs. Wilson is the beloved d efficient Chairman of the Zephyrantheae Committee, and condoces go out to her and the children in their great loss.

1. REGIONAL ACTIVITY AND EXHIBITIONS

THE 1974 AMARYLLIS SHOW SEASON

The 1974 Amaryllis Show season began with the New Orleans tra-Club Amaryllis Show on March 30, and was followed closely by e Greater New Orleans Official All-Horticulture Amaryllis Show on pril 6 and 7. On these same dates over in Texas the Corpus Christi naryllis Show was also staged. These opening events were followed the Amaryllis Society of Mobile (Ala.) Show on April 13 and 14, d the Amaryllis Society of Alabama Show on April 20 and 21. The ain show season ended with the Southern California Hemerocallis d Amaryllis Society Show on April 27 and 28. Other displays and ows sponsored by this Society were staged from February 23 to ne 9.

THE GREATER HOUSTON AMARYLLIS CLUB

Mrs. Sally Fox, *Corresponding Secretary*,
1527 Castle Court, Houston, Texas 77006

The Weatherman in the Gulf Coast area must have had the Energy Crisis" on his mind, as we only had a few nights in the mid 's—one of the warmest Winters on record! As a consequence, our aryllis bulbs were very early in putting up buds. Our show date of pril 21st was too late to have sufficient show quality blooms for the blic to view, so reluctantly we had to cancel our show.

We are looking forward to staging a show in 1975 but, as always, ust depend on growing conditions.

Fig. 4. Some award winners at the 1974 Mens' Amaryllis Club of New Orleans Show; left to right, L. W. Mazzeno, Sr., R. L. Luckett and O. J. Robert, Sr.

NOTE TO AMARYLLIS SHOW ORGANIZERS

It is important to designate some one to write a *brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub, Editor, Amaryllis Year Book, 2678 Prestwick Court, La Jolla, Calif. 92037. *Your plans are not complete until this appointment has been made.* Only in this way is a permanent international record of your show assured.

1974 NEW ORLEANS INTRA-CLUB AMARYLLIS SHOW

L. W. Mazzeno, Jr.
944 Beverly Garden Drive, Metairie, Louisiana 70002

Again this year the Men's Amaryllis Club of New Orleans held an Intra-Club all horticulture Amaryllis Show. The Show, held on March 30, 1974 in the City Park Backer Room, was divided into three categories. Winners were S. P. Gaspereez, best 4-floret specimen 'Apple Blossom'; V. J. Peuler, best 3-floret specimen 'Violetta'; and, J. E. Peuler, best 2-floret specimen 'Salmon Tower'.

The Club's regular annual Show was staged April 6-7, 1974 and is reported separately below.

1974 GREATER NEW ORLEANS OFFICIAL ALL-HORTICULTURE AMARYLLIS SHOW

L. W. Mazzeno, Jr.
944 Beverly Garden Drive, Metairie, Louisiana 70002

The fifteenth annual all-horticulture amaryllis show of the Men's Amaryllis Club of New Orleans was held on April 6 and 7, 1974 at the Kenilworth Shopping Center Mall, New Orleans, Louisiana. Approximately 300 entries provided a beautiful display. Again the competition was open to the public and 29 ribbons and two trophies were won by non-members.

Unusual but true, the "Best in Show" rosette went to an unnamed unregistered hybrid. This beautiful specimen was displayed by Mr. L. W. Mazzeno, Sr. For it he also won the T. A. C. Construction Co. Award and an Award of Merit.

Mr. O. J. Robert, Sr. with a beautiful "Candy Cane" won the James E. Mahan Memorial Award, the Ludwig Challenge Cup, the MACNO Club Trophy, and an Award of Merit.

The Robert Diermayer Memorial Trophy for the best specimen in the Breeder's section was awarded to Mr. Edward Beckham. He also won the Sweepstakes Ribbon for registered and named varieties as well as the George Merz Trophy for most blue ribbons by a Club member, and the Amaryllis, Incorporated Trophy for the best species specimen.

Dual winners were Dr. T. A. Calamari, Jr., the Edward F. Authement Memorial Trophy for runner-up in the unnamed, unregistered

section and the Sweepstakes Ribbon in the unregistered sections; Mr. A. T. Diermayer, the Lester Laine Award for the best double specimen, and the O. J. Robert, Sr. Trophy for the best three-floret registered hybrid, 'Apple Blossom'; Mr. L. W. Mazzeno, Jr., the Laurence Mazzeno Trophy for the best registered *A. gracilis*, and the Ludwig Gracilis Trophy with a 'Constant Comment'.

Other trophy winners were Mr. George Merz,—the W. J. Perrin Memorial Award, for runner-up in the registered section; Mr. J. E. Peuler, the Southern Seed and Popcorn Trophy for runner-up in the breeder's section; Mrs. L. C. Gelbke, the Reuter Seed Company, Inc. Trophy for the best cut flower; Mr. T. A. Calamari, Sr.,—the Vincent Peuler Award for the best registered single floret; Mr. Emile Flauss, Amaryllis Society of Baton Rouge Trophy for the best unregistered single floret; and Mrs. Cathy Gautier,—the Nola Luckett Trophy for best two-floret potted specimen.

Other Club members meriting blue ribbons were Messrs. W. R. Latapie, Sr., V. Pannell, V. J. Peuler, and J. T. Schmidt.

Show Chairman was Mr. Robert Luckett and Co-chairman Mr. E. Macentee. They admirably carried on the Club tradition of staging a well-coordinated, beautiful show. Mr. Al Diermayer did his usual excellent job on the publicity. Club members appeared on local and regional (13 states) TV shows. Our special thanks are extended to all who took an active part in the show, and an added note of gratitude to the Show Judges, members of the Amaryllis Society of Baton Rouge for their assistance, and to the donors of the awards.

1974 CORPUS CHRISTI AMARYLLIS SHOW

MRS. CARL C. HENNY, *Corresponding-Secretary,*
Coastal Bend Amaryllis Society, P. O. Box 3054,
Corpus Christi, Texas, 78404

Once again it is time to report to you as to the results of our annual Exhibit of Amaryllis staged by our Coastal Bend Amaryllis Society in conjunction with the City Council of Garden Clubs "Festival of Flowers", which was held on April 6th and 7th, in our City Coliseum. We had a rather warm winter, with cold northers arriving each weekend; then spring-like weather would last for a week or more, confusing the growth of our bulbs and flowers no end. Many of our Dutch Hybrids bloomed ahead of show time so we were able to exhibit only a few of the Ludwig named and registered varieties. Among those entered were 'Apple Blossom', 'Dawning', 'Fire Fly', 'Picturo', 'Little Sweetheart', 'Bouquet', 'Peppermint', 'Royal Dutch', 'Trixie', 'White Favorite', and 'White Witch'.

Mr. Duane Eckles was awarded the "Silver Bowl Award" for his entry of 'White Favorite' which scored 94 points, and for 'Fire Fly'—which also scored 94 points. He also received the greatest number of blue ribbons in the Ludwig registered and named Amaryllis classes.

Mrs. Wilber Bunselmeyer, non-member, received a Special Trophy

for her entry of 'Apple Blossom', which scored 94 points.

Mr. E. P. Adams, club member, received a Special Trophy for his entry of his 'cross between Royal Dutch and United Nations' in the Breeder's Class, which scored 94 points, and also for his entry of 'Trixie'.

The Council of Garden Clubs presented an "Award of Merit" to Mrs. C. W. Gillespie for her entry of an Apple Blossom seedling, which scored 95 points.

Preliminary Commendation Awards were given to Mrs. C. W. Gillespie, Mr. H. M. Hanscheck, and Mrs. Lee Schroeder for their entries—each scoring 95 points—in the Seedling Division. These Awards were given by the American Amaryllis Society which is affiliated with the American Plant Life Society. Mr. Claud Ward also received this award for his entry of a Striata seedling, which scored 95 points.

A total of 65 entries were judged, with members and non members receiving 26 blue ribbons; 14 red ribbons; 13 yellow ribbons and 2 white ribbons. Judges for the show were Mrs. Robert Arnold, National Accredited Amaryllis Judge from Kerrville, Texas; Mrs. D. A. Ingalls, of San Antonio, Texas and Mrs. Charles E. Weeks of Corpus Christi, Texas, Flower Show Judges.

AMARYLLIS SOCIETY OF MOBILE (ALA.) SHOW 1974

VELMA THOMPSON, *Secretary*
P. O. Box 17, Mt. Vernon, Ala. 36560

The Amaryllis Society of Mobile, Ala., presented its 21st annual Amaryllis show on April 13th and 14th. The theme of the show was "EASTER LORE" and was in memory of Mrs. Marie Dameron, a member who passed away during the year.

In spite of adverse weather conditions there were approximately 293 exhibits, including 24 artistic arrangements. Mr. Huey Summers of Mobile, Ala., was show chairman. Mr. E. A. Wiggins, also of Mobile, is President of the Club.

Mrs. Lois Koontz was the winner of the AMERICAN NATIONAL BANK & TRUST COMPANY TROPHY, awarded to the winner of the most blue ribbons in show, including Horticultural and Artistic Arrangements. Mrs. Koontz also won the following trophies: JOSEPH S. NORTON TROPHY—HORTICULTURAL SWEEPSTAKES, awarded to the winner of the most blue ribbons in Horticultural Division. THE SWETMAN AMARYLLIS GARDEN TROPHY, awarded to the winner of the most blue ribbons in the combined DUTCH HYBRID POTTED AND CUT AMARYLLIS DIVISIONS. THE ROBERT HIRAM SWETMAN MEMORIAL TROPHY, awarded to the winner of the most blue ribbons in THE DUTCH HYBRID POTTED AMARYLLIS DIVISION. THE JOHN J. MASON MEMORIAL TROPHY, awarded for the most outstanding HORTICULTURAL POTTED BULB SPECIMEN OF AMERICAN HYBRID AMARYL-

LIS IN SHOW. THE WESLEY J. MARSHALL SR. MEMORIAL TROPHY, awarded to the winner of the most blue ribbons in THE DUTCH HYBRID CUT AMARYLLIS DIVISION. THE T. J. SWETMAN TROPHY awarded for the MOST OUTSTANDING HORTICULTURAL POTTED BULB SPECIMEN OF SOUTH AFRICAN GROWN HYBRID AMARYLLIS IN SHOW. THE AMARYLLIS SOCIETY OF MOBILE TROPHY, awarded for the MOST BLUE RIBBONS IN THE DUTCH NAMED VARIETIES. THE AMARYLLIS SOCIETY OF MOBILE TROPHY, awarded for the MOST BLUE RIBBONS IN THE UNNAMED POTTED SEEDLINGS. THE AMARYLLIS SOCIETY OF MOBILE TROPHY, awarded for the MOST BLUE RIBBONS IN THE SINGLE BLOOM NAMED DIVISION, and THE AMARYLLIS SOCIETY OF MOBILE TROPHY, awarded for the MOST BLUE RIBBONS IN THE SINGLE BLOOM UNNAMED DIVISION.

THE FIRST NATIONAL BANK OF MOBILE TROPHY was won by Mrs. EDNA CAZALAS, awarded to the winner of the MOST BLUE RIBBONS IN ARTISTIC ARRANGEMENT DIVISION and THE FIRST FEDERAL SAVINGS & LOAN ASSOCIATION TROPHY, awarded for the MOST OUTSTANDING ARTISTIC ARRANGEMENT OF AMARYLLIS IN SHOW.

Mr. JOHN CLARK won the JOHN A. LAMEY MEMORIAL TROPHY, awarded for the MOST OUTSTANDING HORTICULTURAL POTTED BULB SPECIMEN OF DUTCH AMARYLLIS IN SHOW, and THE LUDWIG TROPHY, awarded for the BEST LUDWIG NAMED VARIETY IN THE SHOW, cut or potted.

THE CLAUDE H. MOORE MEMORIAL TROPHY was won by Mrs. NELL KEOWN, awarded for the MOST OUTSTANDING HORTICULTURAL CUT SPECIMEN OF DUTCH AMARYLLIS IN SHOW, and THE AMARYLLIS SOCIETY OF MOBILE TROPHY, awarded for the most BLUE RIBBONS IN THE UNNAMED CUT SEEDLINGS.

THE AMARYLLIS SOCIETY OF MOBILE TROPHY was won by Mr. HUEY SUMMERS, awarded for the MOST OUTSTANDING HORTICULTURAL CUT SPECIMEN OF AMERICAN HYBRID AMARYLLIS IN SHOW.

Mrs. OLIVE RADFORD won THE LUCY WHITWORTH MEMORIAL TROPHY, awarded for the MOST ARTISTIC DESIGN OF AMARYLLIS WITH ELEMENTS OTHER THAN FRESH PLANT MATERIAL PREDOMINATING.

Mr. E. A. WIGGINS won THE INEZ SCHEUERMANN TROPHY, awarded to the winner of THE MOST BLUE RIBBONS IN THE COMBINED AMERICAN HYBRID POTTED AND CUT AMARYLLIS DIVISIONS, and THE AMARYLLIS SOCIETY OF MOBILE TROPHY, awarded for the BEST POTTED MINIATURE.

THE AMARYLLIS SOCIETY OF MOBILE TROPHY was won by Miss CARMON ROMERO, awarded for the BEST CUT MINIATURE.

THE MEN'S GARDEN CLUB OF MOBILE CERTIFICATE OF HONOR was won by Mr. W. A. McCOLLUM, awarded for the BEST AMERICAN HYBRID SEEDLING (in horticulture) SHOWN FOR THE FIRST TIME.

After the judging of the show, the judges were guests of the Amaryllis Society of Mobile, at a luncheon at a Chinese Restaurant.

All members cooperated to make this one of the best shows to be given by the Amaryllis Society of Mobile. It was held in the Mini-Mall at Bell Air Mall.

1974 HOUSTON AMARYLLIS SOCIETY OFFICIAL SHOW

MRS. A. C. PICKARD, *Official Flower Show Chairman,*
1909 Alta Vista, Alvin, Texas 77511

Another year has passed in the annals of the Houston Amaryllis Society culminating the 17th Annual Flower Show.

It is gratifying to know the Society has made history, not only with the American Amaryllis Society, but for many years in National, State and District garden clubs. We deeply appreciate the honors bestowed upon us during the past with this inheritance and the fine spirit of co-operation, unity and understanding the enlargement of our service will continue toward higher goals.

The Official Amaryllis Show of 1974 presents one of the most ambitious efforts to welcome the membership of garden minded hobbyists, devoted to the culture of Amaryllidaceae family.

This has been another milestone year with award winners in the Spring Show. There were surprises from the gardens, as we did get some heavy late frosts and continuous heavy rains in the area. The prospects for a show looked very discouraging in early March. This enthusiastic group of gardeners did not let the poor weather stop them. Many brought choice hybrids in pots that performed very timely for the show. Considering weather and availability of blooms the show was a very interesting display.

Perhaps the best way to talk with you about our show is to walk with a visitor through the show. As she enters, she is confronted with an elaborate display of Dutch named and registered hybrids arranged in their proper divisions and competitive classes. A lavish display of color and blue ribbon winners.

In the center area she finds a score of garden grown seedlings, these blooms challenge the gardener to provide a growing environment. If she gives even one of them her full attention she will be there as much as twenty minutes, being so impressed she will no doubt try her hand at hybridizing in the near future.

Beyond the competitive classes of Amaryllis are the jewels of the show, the flower arrangements, their excellence is breathtaking. Each featuring one or more Amaryllis blooms, but the goodly number

of entries show that such excellence is not beyond the reach of anyone who will devote enough interest to the undertaking.

At this point our visitor turns the corner and finds another group of educational exhibits. Charts, diagrams, and descriptive material illustrate the culture and propagation from the seed to the full grown bulb. Our hosts are devoted to this special area of growing Amaryllis. Mr. and Mrs. E. E. Koon assembled a striking display of every phase of Amaryllis growing including Amaryllids. Tables of soil, fertilizer, mulch, even those pesky bugs, worms and etc. (bottled of course). Continuing in our educational display one may walk over to another table and select the insect repellants one may use, demonstrated by a local dealer.

Moving on the visitor can find the sales table loaded with bulbs, Amaryllids, house plants and innumerable other items related to horticulture. The results these few dollars derived from the sales help support the Society's public service programs, plus a lot of friendship and aid to horticulture. So much for the partial content of the Show as seen through the eyes of a single visitor.

Now let's take a moment to review the theme of the Show "Amaryllis our Pride", with winners of awards and blue ribbons. Mrs. L. E. Morgan,—award of merit on Ludwigs 'Apple Blossom.' Second highest went to Mrs. O. W. Hanson, with 'White Favorite'. Others in close competition were Mrs. Clem Smith on Ludwigs 'Marie Goretti'. In the Breeders Class Mrs. A. L. Hammond highest score with her Dutch Seedling. Others in the blue ribbon Breeders Class were Mrs. Bell Wright, Mrs. W. Birch and Mrs. O. W. Hanson. In The American Seedling Class blue ribbon winners were Mrs. Enoch Johnstone and Mrs. Clem Smith. The old Johnsonii which is becoming more scarce proudly boasts her blue ribbon in the Belladonna Division, entry by Mrs. Clem Smith who also was awarded the Sweepstakes. Honors go to Mrs. Ada Blankenship for the best in the Artistic Section.

Finally the weary exhibitors dismantle and close the doors for only a short time. The Society staff and flower show committee are reviewing the results, comparing notes and comments and starting to work to expand to make next years show the best ever.

THE AMARYLLIS SOCIETY OF ALABAMA INC. SHOW—1974

Mrs. H. A. (Mae) Allen, *President*
210 Alpine St., Chickasaw, Ala., 36611

The Amaryllis Society of Alabama Inc., held its Seventh Annual Spring Show at the Chichasaw Civic Center on Grant Street in Chickasaw, Alabama on April 20th and 21st, 1974. The theme of the show was "Amaryllis in Chickasaw". There was much interest shown in both the horticulture and artistic arrangements divisions. Mr. Fred Fambrough was the Show Chairman.

Mr. C. E. Tagert of Mobile, Alabama won the American National k Trophy for the best named dutch potted specimen in the show. addition, Mr. C. E. Tagert won the following ten trophies: PRESI-NT'S AWARD: for most outstanding Dutch seedling hybridized brought into bloom by exhibitor and being shown for first time ision VIII. Large silver tray with handles. CHAVIS FURNI-RE COMPANY TROPHY: to winner of the most blue ribbons in rticulture. Divisions I-VIII. Large silver tray with handles. HILE SCHEUERMANN, SR. MEMORIAL TROPHY: to winner the most blue ribbons in combined horticulture and artistic arrange-ent division. Silver champagne cooler. THE WILMER SMITH ROPHY: for most outstanding potted bulb specimen in the show. lver pitcher. THE AMARYLLIS SOCIETY OF ALA., INC. ROPHY: to winner of the most blue ribbons in the cut Dutch divi-on. Division IV. Silver tray. MERCHANTS NATIONAL BANK ROPHY: for most blue ribbons in horticulture Divisions I through VII. Silver tray. MARTHA BURDETTE MEMORIAL TROPHY: for most blue ribbons in Divisions V and VI. Silver tray. THE VINCENT KILBORN SR. MEMORIAL TROPHY: for most blue ribbons in Division IV. Silver bowl. THE C. E. TAGERT, SR. TROPHY: for most blue ribbons in the single bloom unnamed division. Small silver bowl. ROSES DEPARTMENT STORE AWARD: for most blue ribbons in the single bloom named division. Can Opener.

Mrs. A. R. Simpkins of Mt. Vernon, Alabama received the following trophy: MR. & MRS. H. P. WHEAT MEMORIAL TROPHY: to winner of the most blue ribbons in the potted and cut seedling divisions. Divisions VII and VIII. Large silver tray with handles.

Mrs. Marie Cantrell of Chickasaw, Alabama won the following trophies: CLAUDE H. MOORE MEMORIAL TROPHY: for most outstanding horticultural specimen of potted Dutch Amaryllis in the show. Division III. Silver tray. THE T. J. SWETMAN TROPHY: for most blue ribbons in Division III. Large ceramic tray.

Mr. Fred Fambrough of Prichard, Alabama, won the following trophies: CENTRAL BANK OF MOBILE TROPHY (Formerly Deposit National): for most blue ribbons in the American potted Amaryllis, Division I. Silver tray. THE FIRST NATIONAL BANK OF MOBILE TROPHY: to best specimen in Division VII. Silver Paul Revere Bowl.

Mrs. Irene Massingill of Chickasaw, Alabama won the following trophies: SULLY'S DRIVE-IN TROPHY: to winner of the most blue ribbons in the artistic arrangements division. Silver bread tray. WEST DEPARTMENT STORE AWARD: for most blue ribbons in artistic arrangements. Division XII. Ladies Timex Watch.

Mrs. Velma Thompson of Mt. Vernon, Alabama received the following trophy: THE LITTLE GLASS SHACK AWARD: for most outstanding cut miniature of Dutch Amaryllis. Crystal Vase.

Mrs. Horace Young of Chickasaw, Alabama won the following trophies: ELLEN "JACK" CROPP TROPHY: for most artistic

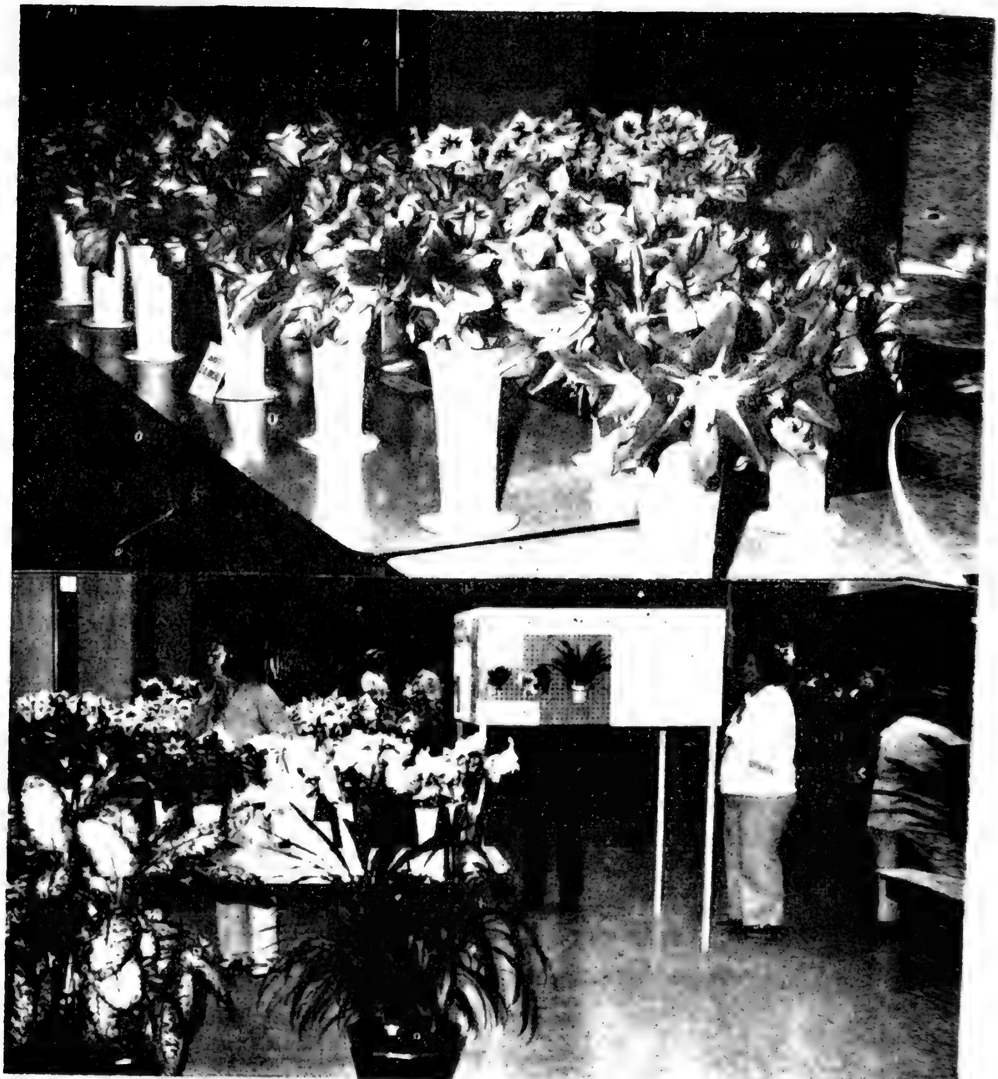

Fig. 5. Southern Calif. Hem. & Amaryllis Show, 1974. **Upper**—Cut **Amaryllis** blooms from Mr. E. A. Angel's **Amaryllis** field at Colton. **Lower**—part of educational exhibits. Photos by C. D. Cothran.

design of amaryllis with elements other than fresh plant material predominating. Silver award. VELMA THOMPSON TROPHY: for most outstanding artistic arrangement in show. Relish dish.

Mrs. Claudine Pierce of Mt. Vernon, Alabama received the following trophy: CLAUDINE PIERCE TROPHY: for most outstanding collection of three (3) scapes in Division X. Ceramic Vase.

Mr. Dewey Hardy of Eight Mile, Alabama received the Cecil Bates Trophy for the Educational Display.

In the non-member class, Mrs. Lois Koontz of Mobile, Alabama, won the Amaryllis Society of Alabama, Inc. trophy for the most outstanding potted amaryllis, and also the Amaryllis Society of Alabama, Inc., trophy for the most outstanding cut amaryllis.

The horticulture judges all from Hattiesburg, Mississippi were: Mrs. Luther N. Davis, Mrs. Sam Forbert, Mrs. Lillie Wilson, Mrs. B. M. Lewis, Mrs. Maye Gaucher, Mrs. C. N. Woods, Mrs. Ethel F. Newton, Mrs. Mollie Fowler, and Mrs. E. R. Trussell.

Artistic arrangement judges were: Mrs. J. T. Barfield, Pensacola, Florida, Mrs. Homer W. Davis, Gonzalez, Florida, Mrs. F. A. Meloy, Milton, Florida, Mrs. J. E. Haynes, Pensacola, Florida.

After the judging of the show, the judges were guests of the Amaryllis Society of Alabama Inc., at a luncheon at a Mobile Restaurant.

SOUTHERN CALIFORNIA HEMEROCALLIS AND AMARYLLIS SOCIETY SHOW, 1974

C. D. COTHRAN, *Show Chairman*
1733 North Gibbs St., Pomona, Calif. 91767

The tenth annual show of the Southern California Hemerocallis and Amaryllis Society was held at the Los Angeles State and County Arboretum Lecture Hall in Arcadia on April 27 and 28. As the flowers began to arrive it became apparent that the selection of the theme "Garden Jewels" was truly inspired this year, as this was really a vintage year for Amaryllis. As a background, several hundred of the finest flowers were selected from the thousands available from E. A. Angel, Bruce Claflin, and E. Pencall. These were arranged in vases with the colors of the flowers grouped to make a wave of color from burgundy to white, and this is what the visitor saw as he first entered the auditorium.

A table at the front of the auditorium had the silver and crystal to be awarded as prizes. It also had a large bowl of wine red amaryllis with a strong white star in the throat, which was particularly effective with the silver. This was planned by Gladys Williams, Show Standards Chairman.

Fifteen beautiful arrangements were made and placed by Mrs. Macdonald, all using amaryllis as their principal theme. They were an inspiration to many visitors who asked numberless questions about them.

There were 134 amaryllis entered in competition, all of exceptional quality. The following awards were made by judges Polly Anderson, Jack McCaskill, Roger Fesmire, Quinn Buck, and senior judge Gladys Williams:

Sweepstakes—A first for C. D. Cothran who received the SCH and an award.

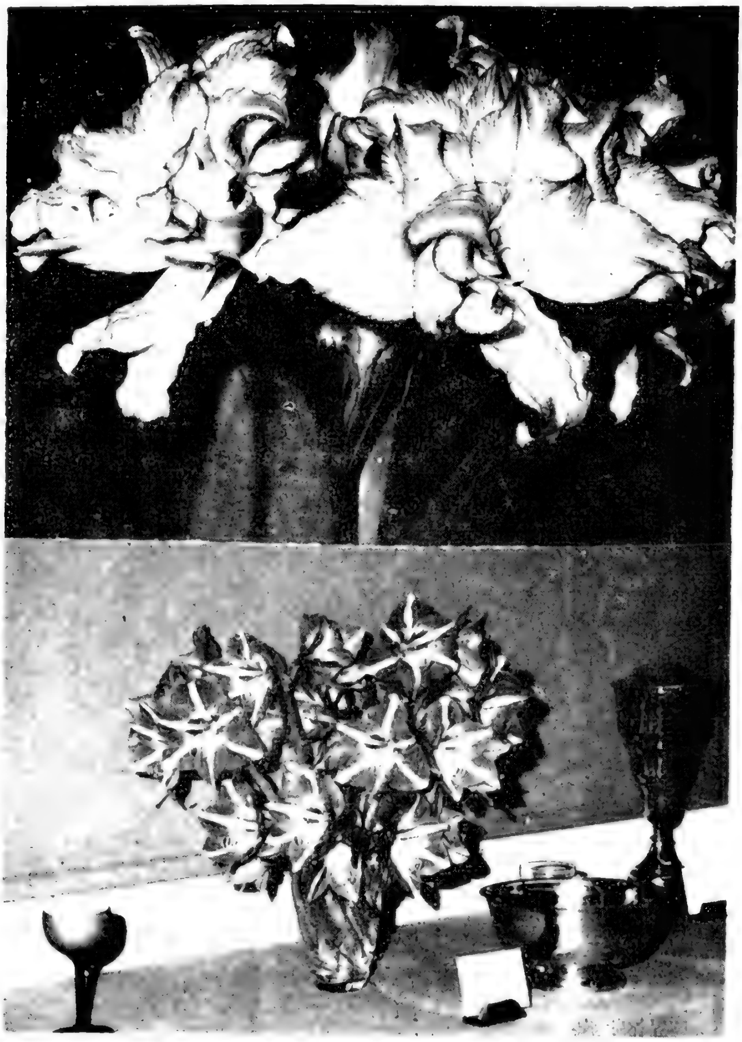

Fig. 6. Southern Calif. Hem. & Amaryllis Show, 1974 . **Upper—Amaryllis** clone 'Double Beauty', which won the Judges' award and the 1974 popularity poll. **Lower,**—Some trophies, and large bowl of wine-red **Amaryllis.** Photos by C. D. Cothran.

Runner up—Leonard Doran who received a SCH and an award.

Best registered large flowered hybrid (other than Ludwig) "Rembrandt" to L. Doran.

Best flower in show. Judges award—Large double seedling to C. D. Cothran.

Popularity poll winner. Large double seedling by C. D. Cothran.

Henry Myers won three SCH and an award in Section 3, Hybridizers class with the best Leopoldii seedling, the best Reginae seedling, and the best seedling with the highest point score. The award for the best Belladonna hybrids went to C. D. Cothran.

American Amaryllis Society Awards of Merit were given to C. D. Cothran for 'Fritz Kreisler', and Leonard Doran for 'Rembrandt'. Both were almost perfect, and bloomed just for the show, and remained in beautiful condition throughout the whole period of the show.

This was a good year for Preliminary Commendations also. The following were awarded:

Leonard Doran for a lovely picotee.

C. D. Cothran for a wonderful double seedling.

Henry Myers for a beautiful Leopoldii orange seedling.

C. D. Cothran for a very fine Belladonna type seedling.

Rosettes are awarded to groups, or to individuals who make big efforts to make the show more beautiful and attractive to the hundreds of visitors who come to see it. In this case the Rosettes were awarded to:

Mrs. D. Macdonald for the beautiful arrangements.

E. A. Angel for the huge displays of cut flowers.

Bruce Claflin for masses of cut flowers mostly red.

Ed Pencall for a large display of Dutch type cut flowers.

And the Special Judges Ribbons sometimes tell you where the judges heart really is, but one has to follow the rules, and these awards were made:

C. D. Cothran for 2 pots with more than a dozen scapes each of the species hybrid "Senorita".

Leonard Doran for a pot of the species *A. aglaiae* in bloom, the first to be seen in this area. Also for a pot of *A. blumenavia* in full bloom. This is very difficult to bloom, and was a first view for almost everyone.

Sterling Harshbarger for an unusual miniature.

Henry Myers for a lime green seedling, both a good flower, and an unusual color.

In addition to the "popularity poll", which caused the visitors to look at all of the flowers very carefully, a small packet of amaryllis seed was given to each visitor who wanted it. This raised many questions about culture and the Society members tried to answer them. As a result about 25 people joined the society, and most of the others were very impressed with the Show and the Society members with whom they came in contact. Most of them enjoyed the educational exhibit which had been prepared by Jim Weinstock. An educational exhibit on

Hemerocallis had also been prepared by Mrs. Gardner, and Mrs. Lewallen. We believe that much enthusiasm was generated, and that we will have an even more extensive show next year.

The Society has been very active this year in the matter of displays and flowers shows. In February (the 23rd) Mrs. Dorothea Boldt, Mrs. Mildred Cothran, and the writer put in a large table exhibit of Senorita and other species hybrids at the California State College at Fullerton flower show. Mrs. Boldt also had some very nice early hemerocallis blooms. This show is to advance the cause of The Arboretum which is nearby the College.

Following the Society Show in April, a large exhibit of cut and potted amaryllis, and hemerocallis was arranged in the Lecture Hall of the Arboretum in connection with the "Spring Extravaganza At the Arboretum" put on by The California Arboretum Foundation and the Los Angeles State and County Arboretum. The number of visitors approached thirty thousand, and it seemed that most of them had a question about the amaryllis. This event covered two days from 8am to 5pm and the Society had hosts and hostesses there the entire period and made many friends.

The fourth show was the Hemerocallis Show at Descanso Gardens on June 9th. There were quite a few entries of cut hems from several exhibitors, and a very large number from Quinn Buck's garden. He also brought a number of plants flowering in pots. Altogether it was a very impressive display. Since it was a first we can certainly look forward to even better shows in the future.

PLANT LIFE LIBRARY—continued from page 5.

PLANT CELL STRUCTURE AND METABOLISM, by J. L. Hall, T. J. Flowers and R. M. Roberts. Longmans, Inc., 72 5th Av., New York City 10011. 1974. Pp. xi + 426. Illus. Paper, $14.50.—This attractive and generously illustrated text is suitable for s'udents at the college and university levels. In Chapter 1, an outline of cell structure, some techniques used in cell science are presented. Chapter 2 deals with a sufficient background of cell chemistry for the book to be read by the non-specialist, and in addition membranes are discussed in some detail. The rest of the chapters are devoted to the structure and biochemical properties of the soluble phase of the cell and the major cellular organelles. The author and subject indices complete the volume. Very highly recommended.

PLANT LIFE LIBRARY—continued on page 63.

2. LINEAGICS

[BIOEVOLUTION, DESCRIPTION, DETERMINING RELATIONSHIPS, GROUPING INTO LINEAGES]

CONTRIBUTION TO PERUVIAN AMARYLLIDACEAE

CESAR VARGAS CALDERON,
Apartado 79, Cuzco, Peru, December 1973

The present article includes new species in the following genera of the Amaryllidaceae: *Hymenocallis*, *Amaryllis* and *Eustephia*. I have still under cultivation a number of *Hymenocallis* and *Amaryllis*, to be described in the near future, and also I plan and expect to collect in unexplored areas in South Peru. In some cases I have enough bulbs to be distributed for introduction; the new species are as follows:

Hymenocallis Hawkesii Vargas **sp. nova** [Fig. 7.]

Bulb, 8.5 cm long, 5.5 cm wide, neck 10 cm long. *Scape* about 66 cm tall, 18 mm wide at the base, 10 mm at the apice; *spathe valves* lanceolate, longer than the perianth tube, yellowish, membranaceous. *Umbel* 3-5 flowered, fragrant, *pedicels* 12-15 mm long, 3 mm wide angular, greenish, 26-30 mm long in fruit; *ovary* triangular greenish 12 mm long, 55 mm wide. *Perianth tube* greenish, 46 mm long, 3.5 mm wide; *tepals* white-yellowish; parandroecium campanulate, greenish-yellowish toward the base, whitish toward the rim, 6-7 mm wide at the base, 40 mm diameter, 48-50 mm long at the borders, dentate-laciniate; *stamens filaments* 10-12 mm long, *anthers* yellow 6-7 mm long, 1 mm wide, *pollen* yellow; *style* clear green 10 mm longer than the stamen, *stigma* almost visible; *fruits* fericus, leaves 3 lanceolatae, obscurely erect, 52 cm long, 42-48 mm wide.

Bulbus ovoideus, 8.5 cm. longus, 5.5 cm latus; collum 10 cm. longus. Scapus 66 cm longus, 18 mm latus, ad basim 10 mm latus ad apicem acute angulatum; bracteae, tubum perianthium flavum et membranaceum superant; umbella 3-5 flora, aromatica, pedicellus, 12-15 mm longus, 3 mm latus, paule angulatus, viridis, in fructum 26-30 mm longus; ovarium triangulatum viride, 12 mm longum, 5 mm latum; perianthium, tubus viridis, lineolatus, 46 mm longus, 35 mm latus; tepala alba in nervo centrali subflava; sepala oblonga, angustiora quam tepala unguis 6 mm longus, viridis; petala oblonga, in medium 12 mm lata, unguis paene visibilis; paracorolla anguste campanulate, viridis, at basim flava, apex vel fuax albidulus, ad basim 5-7 mm lata, in faucibus 40 mm lata, 48 mm lenga, dentato laciniata, cum fissuris inter segmenta usque at 9 mm profundis; androceum, stamina 10-12 mm longa, antherae luteae, 6-7 mm longae, 1 mm latae, polline pallidus luteo; ginoceum viridum, stylus plus quam stamina 10 mm exsertus, stigma paena visibilis; fructus sphaeroideus; folia in quoque scapo 3 lanceolatus, oblique-erecta, 52 cm longa, in medium 42-48 mm lata.

costa subtus notate.

This species has been named for Dr. John Hawkes a good friend of mine and a well known scientist and research worker on potatoes (University of Birmingham) in England.

Perú: Department of Cuzco, Province of Quispicanchis, Lucre, 3050 m, C. Vargas C., 16995, type in CUZ, (Herbario Vargas Cuzco, Perú).

Fig. 7. **Hymenocallis hawkesii Vargas.**

Eustephia kawidei Vargas **sp. nova.** [Fig 8.]

Bulb ovoid, 3-4 cm long, 4 mm wide; *scape* 30 cm long almost angular; *umbel* 3-5 flowered; *perianth* lemon yellow 42 mm long, tubu-

lar; sepals and petals narrow at the base, spatulate at the apex, *pedicels* 4 cm long, green, *bracts* lanceolate, whitish; style 1 cm longer than the stamens; *stigma* pyriform, *stamens* shorter than the pistil, *filaments* narrowly winged, acute 2-3 mm long the teeth; *fruit* sulcate, seeds plane brownish with the border transparent. 8 mm long 2 mm wide.

Bulbus ovoideus, 3-4 cm longus, scapus 30 cm longus, ad basis 4 mm latus, subangulatus. Umbella 3-5 flora. Perianthum citrinum, 42 mm longum, tubulosum, ad basim angustatum, ad apicem latum; spata petalaque spathulata ad basim angustata, pedicelli usque ad 4 cm longi, inaequali, quam scapus viridi; bracteae lanceolatae, membranaceae, albidae, bracteolae filiformes; androceum, stamina in maturitae marginem tepalorum attingentes; ovarium subtetragonalis, alae lanceolatae, acutae, 2-3 mm longae. Fructus trilobulatus, semina plana. Folia plura, 66 cm longa, 5-6 mm lata.

Eustephia kawidei is related to *E. coccinea*, but differs in the perianth, color and size, and also in the form of the stamen appendages. It is named in memory of *Kawide*, the legendary Quechua hero, Manco II. Inca. *Kawide* died fighting at the Sajsaiwaman fortress, alt. 3550 m.

Perú: Departamento Cuzco, Provincia Cuzco: Sajsaiwaman Fortress, 3550 m. (C. Vargas C., 22386, TYPE, CUZ).

Amaryllis variegata Vargas **sp. nova** [Fig. 8.]

Bulb subglobose, 4-6 cm long, neck 3-4 cm long. *Scape* greenish 35-42 cm long, *two bracts*, exceedingly the ovary, *pedicels* lightly greenish, 6-6.5 cm long, 10 mm wide; *umbel* 2-flowered, *ovary* purple 20 mm long, 8 mm wide. *Perigone*, 15-16 cm diameter, tube 3-4 mm long, *paraperigone* almost absent, only few bristles, 44mm long; throat with short greenish-white star, *tepalsegs* obovate, acute 3.2-4 cm wide at the middle, the lowest tepal narrower, brilliant red, with red and white dotted at the inferiore 3 tepalsegs, a typical characteristic and variable one accordingly with the different clones; *stamens* shorter than the perianth, *anthers* yellow, 7 mm long; *style* longer than the perianth, *stigma* trilobed; *fruit* trisulcate, seeds brownish, membranaceous; *leaves* 5 or 7 after flowering, lanceolate, acute, 44-50 cm long 2.7 cm wide.

Bulbus subrotundus, 4-6 cm longus, collum 3-4 cm longum; bractea, ovarium superantes, lanceolatae, rubrae; umbella biflora, ovarium rubrum, 20 mm longum, 8 mm latum; perigonium in faucem 15-16 cm diam. tubus 3-4 mm longus, stella lata albido-viridia, tepala obovata, acuta, in medium 2.3-3 cm lata; inferus angustior, ruber, flammeus, tria inferiora rubroquealbo maculata, character variabilis, vel aliquando flava; androceum, filamenta quam perianthium breviora, antherae flavae, 7 mm longae; gineceum, stylus quam perianthium longius, stigma trilobum; fructus et tamquam semina trilobulatus, semina fusca, membranacea in D; folia 5-7 post anthesis exeuntia, anguste lanceolatae, acutae, 44-50 cm longae, 2.7 cm latae. Species colore valde variabilis, ut mihi videtur hibrida.

Perú: Departamento Puno, Province Sandia, near Oconeque, 1800 m., C. Vargas C., 16423, TYPE in CUZ, (Herbario Vargas, Cuzco). Under cultivation.

Amaryllis bukasovii Vargas, **sp. nova.**, [Fig. 8.]

Bulb subglobose, 6-8 cm long; *scape*, 38-40 cm long, 1 cm wide at the base, subterete; *bracts* 2 lanceolate exceedingly the ovary; *Umbel* 2-flowered, *pedicels* 4.5-5 cm long, 5 mm wide; *ovary*, purple 1.5 cm long 7 mm wide; *perigone*, 10 cm long, 12-14 cm diameter, *tepaltube* 8-10 mm long, *paraperigone* almost absent, only a few bristles, 6 mm long; throat with a large greenish white star; *tepalsegs* obovate, acute, narrow at the base, 3.5-3.8 cm broad at the middle, the lowest narrower dark red, greenish yellow at the tip to the tepalsegs, and about 2-2.5 cm at the superior tepalseg and 3 cm or more at the tip of the lowest tepalsegs; stamens shorter than the perigone, *anthers* yellow 6-7 mm long, slightly incurved at the middle; *style* as long as the perigone segments, *stigma* clearly trilobed. Leaves 5-7 after flowering.

Bulbus subesfericus, 6-8 cm longus. Scapus 38-40 cm longus, ad basim 1 cm latus, subteres; bracteae lanceolatae, ovarium superantes, albido-rubrae. Umbella biflora, pedicelli 4.5-5 cm longi, 5mm lati; ovarium purpureum, 1.5 cm longum, 7 mm latum; perigonium 10 cm longum, ad fauces 12-14 cm diam. tubus 8-10 mm longus; paraperigonium, pili hialini, 6 mm longi, stella longa albido-viridia; tepala obovata, acuta, ad basis angustata, 3.5-3.8 cm lata, in medium; inferus angustior, sanguineus, macula terminali sulphurea instructa, in tepalis superioribus 2-2.5 cm diam. et inferioribus 3 cm diam; androeceum, stamina quam perigonium breviora, antherae flavae 6 mm longae, curvatae; gineceum, stylus tanquam tepala longus, stigma trilobum; folia anguste lanceolata, 5-7 post anthesis exeuntia, 40-45 cm longa, 3-3.5 lata.

Perú: Department of Puno, Province of Sandia, bridge at San José, 1400-1800 m. C. Vargas C., 21882, type in CUZ, (Herb. Vargas, Cuzco). This species has been named for Dr. S. Bukasov, my good friend, and well known scientist and research worker with potatoes in Russia, Leningrad.

Amaryllis machupijchensis Vargas, **sp. nova.**

Bulb subglobose, 7 cm long, neck 7 cm long. *Scape* 22-25 cm long, (sometimes 80 cm long), clear greenish, brilliant, slightly angular toward the base and reddish; *bracts* 2, clear red, 7.5 cm long, lanceolate; *umbel* 2-flowered in the type, (but frequently 3-4 flowered), *pedicels* 4-4.5 cm long; *ovary* 18 mm long, 8 mm wide; perigone open to 18 cm, exterior greenish-yellowish, minutely spotted with red, interior, greenish-whitish as the stamens this one is wide toward the base, tube 4-6 mm long, *paraperigone*, whitish, transparent, slightly laciniate; *tepalsegs*, 3.4-3.8 cm wide, obovate, acute; *stamens* as long as the tepalsegs, greenish whitish, and red spotted, anthers incurved 6 mm long, *pollen* yellow:

Style longer than the tepalsegs, *stigma* trilobulate; *fruit*, trigone, *pedicel* at maturity of the fruit 7-9 cm long, *seeds* D-shaped; leaves, 5-7, after flowering, 70 cm long, 2.7-3cm wide.

Bulbus subesfericus, 7 cm dim., collum 7 cm longum. Scapus 22-25 cm in typo ad 80 cm in alliis, longo, viride, ad basim rutilans; bracteae 2, rubrae, 7.5 cm longae, ovarium superantes, lanceolatae; Umbella biflora; ovarium viride, 18 mm longum, 8 mm latum; perigonium apertum usque virido-albidum, stella at basim lata, dense rubro

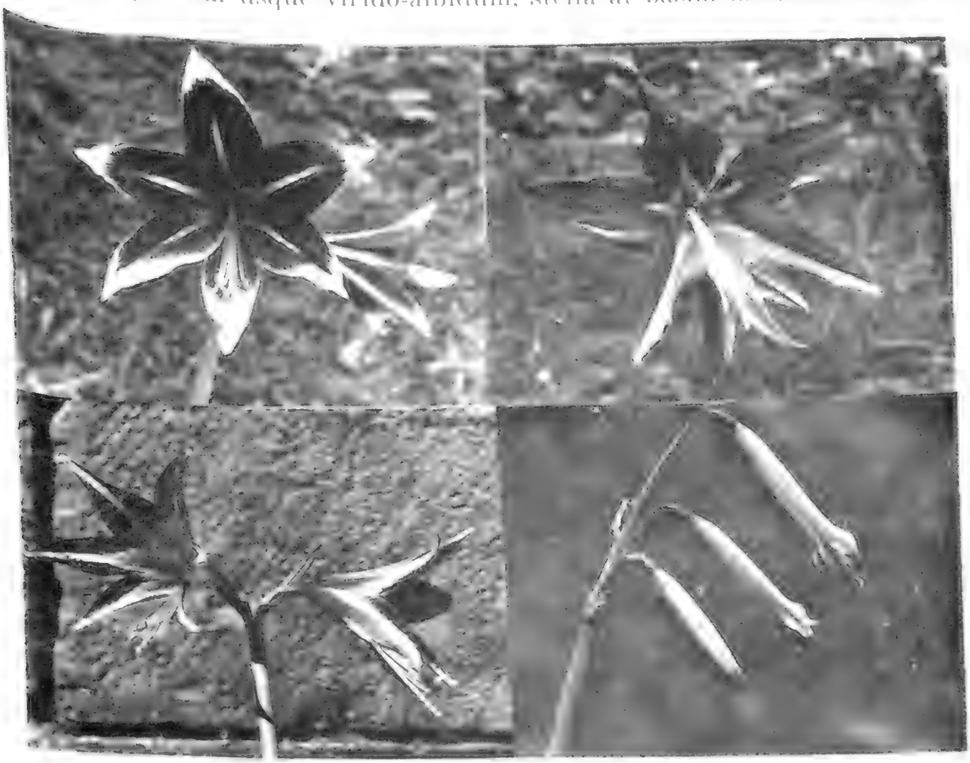

Fig. 8. Three new **Amaryllis** species—**Upper left, Amaryllis bukasovii** Vargas; **upper right, A. varigata** Vargas; **Lower left, A. cuzcoensis** Vargas; and, **lower right, Eustephia hawidei** Vargas.

maculata, variabilis; tubus 4-6 mm longus, paraperigonium albidum, hialinum, perpauce laciniatum; tepala, 3.4-3.8 cm lata, oval acuta, subaequalia praeter tepalum inferum majorem, plus rubro-variegatum; androceum filamenta tepala aequantia, dimidium inferum viride album, altera tanta protio rubro-variegata; antherae incuravae, 6 mm longae, pollinae luteo; gineceum, stylus 8 mm longior quan tepala, dimidium album, dimidium alterum rubrum, stigma trilobum; fructus trigonus, semina in D, fusca, 18 mm longa, 14 mm lata; folia post anthesis 6-7,

usque ad 7 cm longa, usque ad 27 mm lata, lanceolata, acutaque, glauca.

Perú: Department Cuzco, Province, Urubamba, Pampak'wa, type, C. Vargas C., 17652, (also: 19983), 2250 m. Also collected at: Province, Convención, CVC, 21878, Sta. Rosa, 1000 m; Province, Calca, Lares valley, CVC, 22272, at San Pedro, 1500 m. Also collected by me at Machupijchu, 2000 m., in forest.

Amaryllis cuzcoensis Vargas, **sp. nova,** [Fig. 8.]

Bulb subglobose 5 cm long, neck 5.5 cm long. *Scape* subterete, 32 cm long, greenish-reddish at the base; *bracts* 2, green-reddish exceedingly the ovary in 30 mm; *umbel* 2-flowered, reddish, 2.5-3-4 cm long the pedicels; *ovary* greenish 18 mm long, 8 mm wide; *perigone*, almost always horizontally, 13-14 cm long, exterior dark red and greenish whitish, interior dark red, with large, greenish whitish star, very wide at the base, a white line bordering the tepalsegs which are oblong, lanceolate, 9-10 cm long 2.5-3 cm wide, *tube*, 3-4 mm long. *Stamens* shorter than the tepalsegs, (type specimen), *anthers* 4 mm long, *pollen* yellow; *style* as long as the tepalsegs, greenish-whitish, *stigma* trilobate; fruit pedicel 55 mm long; the *capsule*, greenish-reddish, trisulcate 22 mm long, and 30 mm wide, *seeds* brown, almost roundish. *Leaves*, 5-7, lanceolate, acute, narrow, 36 cm long, 17-18 mm wide at the middle.

Bulbus subesfericus 5 cm diam. in medium, collus 5.5 cm longae. Scapus subteres, 32 cm longus, viride, ad basim laeviter rubrum, bracteae 2, virides, perpaulo rubrae, 30 mm ovarium superantes, umbella biflora, bracteolas nullae, pedicelli 2.5-3-4 cm longi, viridi atque teretes; ovarium viride, 18 mm longum, 8 mm latum; perigonium horizontale, 13-14 cm diam. extus rubrum, postea albido-viridulum tanquam raquis, intus rubrum, stella magna, albido, viridula, quam apicem tepalorum attingens, tepala oblong-lanceolata cum margine albo 3536 mm latae, ad basimangustae, tubus 3-4 mm longus; androceum stamina tanquam tepala breviora, filamenta albida, antherae 4 mm longae, polline luteo; gineceum, stylus tanquam longius, albido-viridus, stigma paene trilobulatum. Folia 5-7 angustae, pallido-viridae, 35 cm longae, 17-18 mm latae in mediu.

Perú: Department of Cuzco, Province Calca, Type, C. Vargas C., 22395, (CUZ), Hacienda Vilcabamba, 2800 m. o s. 1.

THE KORSAKOFF AMARYLLIS HYBRIDS

WILLIAM D. BELL, *Fairchild Tropical Garden,*
10901 Old Cutler Road, Miami, Florida 33156

A familiar sight greeted me one spring morning at the U.S.D.A. Subtropical Horticulture Research Station in Miami, known locally as Chapman Field. Flowering along the south end of a greenhouse was a bed of what had to be diploid amaryllis hybrids. Shades of salmon predominated and most had a pale yellow cast if not a bright yellow throat. The number of scapes per unit area was truly overwhelming.

Furthermore, these hybrids seemed to be well suited for culture on the coral limestone marl of South Florida.

Mr. Paul Soderholm, Horticulturist at the Station, said they had been sent by Alek Korsakoff, a former resident of the Miami area (see autobiography in PLANT LIFE vol. 25, 1969). Accession records indicated that they had been received from Mr. Korsakoff in 1968 as *Amaryllis starkii* x *evansiae* (later named 'Teddie Buhler'), *A. striata* x *evansiae* and *(A. mastersii* x *evansiae)* x *evansiae*. With Mr. Soder-

Fig. 9. Korsakoff **Amaryllis** hybrids growing at Chapman Field, Miami, Fla. Photo by Dr. William D. Bell.

holm's permission, I made a number of pollinations with other hybrids or species I knew had been in Mr. Korsakoff's collection to perpetuate and increase the "Korsakoff hybrids". Sufficient numbers of seedlings have been started that it appears that the Korsakoff amaryllis hybrids can be included in the Fairchild Tropical Garden plant distribution program for 1975. As an annual event, plants which are not readily available commercially are offered to members for a nominal sum. It may stretch the tradition of Dr. Fairchild a bit to offer hybrid plants, but we plan this to honor our late friend, Alek Korsakoff.

OVARY APEX ELONGATION IN **CRINUM** L.

Hamilton P. Traub

In the past, the tepaltube in *Crinum* L. species was described as including everything beginning with the immediate more or less rounded apex of the enlarged part of the ovary and the base of the tepalsegs above. However, beginning with the report of the antenna-like ovarian projections above this point (Traub, 1958, 1962; Shirley 1963, 1964) in *Crinum* species, this concept had to be given up when

this condition is present. The actual tepaltube which dries up with the fading of the tepalsegs can easily be distinguished from the antenna-like ovarian projections, when present, because they live on as an integral part of the ovary and die only after the seeds have matured in the indehiscent ovary case. Then after the dead ovary case with projections have disentegrated sufficiently, the seeds are released.

If it is desired to make the descriptions true to nature, this condition has to be described as it actually is, indicating the actual lengths of the elongated ovary apex, and the lengths of the tepaltube above. In some cases the elongated apical ovarian projections are quite long as reported for *Crinum strictum* var. *traubii* Moldenke (Traub, 1958, 1962), or they may be shorter, or absent.

To make the subject quite clear, the apical ovarian projections were checked in the case of *Crinum* hybrid, 'Elizabeth Traub' (Traub 1931) (*Crinum scabrum* x *C.* clone 'Ellen Bosanquet'), which happened to be in flower when this note was written, as shown in Table 1.

Table 1. Variations in elongated ovray apices and tepaltubes in **Crinum** "Elizabeth Traub", in 1974.

Floret in umbel	Elongated ovary apex, cm	Length, tepaltube cm	Total length, cm.
Floret #1	0.0	9.0	9.0
Floret #2	0.6	8.7	9.3
Floret #3	2.0	7.0	9.0
Floret #4	2.2	6.6	8.8
etc. etc.			

In cases such as the above, if not the actual varying lengths of the elongated ovary apex and the tepaltube are indicated, then at least it should be reported that the condition is present.

LITERATURE CITED

Shirley, Mrs. Carl. Adventures with native *Crinums*. Plant Life 19: 42-43, Fig. 11, 1963.

———. Further notes on American Crinums. Plant Life 20: 41-43, Fig. 12. 1964.

Traub, Hamilton, P. Robust from of *Crinum americanum*. Plant Life 14; 51-52. Fig. 7. 1958.

———. Long lost American *Crinum* Found (C. strictum Herb.) Plant Life 18; 47-48. 1962.

ADDITIONAL NOTES ON **NOTHOSCORDUM MAHUII**

HAMILTON P. TRAUB

This interesting dwarf species, *Nothoscordum mahuii*, was recently proposed (Traub, 1973), and information on its bulb was added the following year (Traub, 1974). This has to be amplified in this brief report on the basis of further information.

This tiny plant has greatly surprised the writer during the year 1974. It was assumed up to 1974 that the bulbs do not produce offsets.

but this observation was shattered in 1974 when the bulb split into 17 clove-like bulblets similar to those produced in Garlic, *Allium sativum* L. as recorded in Table 1.

Table 1. **Nothoscordum mahuii** Traub; number and size of cloves produced from one bulb under optimum pot culture in 1974.

Number of bulbs	length, mm	width, mm		length, mm	width, mm
1 very tiny	7	3	to	—	—
2 tiny	10	5	to	11	6
5 small	14	6	to	15	7
5 medium	18	8	to	20	9
4 "large"	20.5	9.5	to	21	10

Previously it has been reported that 3 to 4 flower scapes per bulb are produced each season, each umbel with three flowers. In 1974, the bulb outdid itself and produced up to 8 leaves and up to 11 flower scapes. The first 8 each had 3 florets per umbel, the 9th had 2 florets, and the last two 1 floret. This same bulb split later into 17 bulblets as shown in Table 1.

The plant can be grown in a 3-, to 4-inch pot, with a few bulbs in each pot. The plant appears in early winter and flowers until March, a little later it dies down and rests for the remainder of the year.

What makes this plant so valuable is the fact that it is easily handled in a class room, and blooms during the school year so that teachers and students may use it as an experimental object for chromosome, breeding, physiological, and other experiments. For the rest of the year it may be preserved in the small pots entirely dry until the next season when it should be repotted.

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Traub, Hamilton P. *Nothoscordum mahuii.* Plant Life 24: 1973.

———. Amaryllid Notes, 1973 [Bulb of *Nothoscordum mahuii*] Plant Life 30: 86. 1974.

REGISTRATION OF NEW AMARYLLID CLONES

MR. W. D. MORTON, JR., *Emeritus Registrar*

MR. JAMES M. WEINSTOCK, *Registrar*
10331 Independence, Chatsworth, Calif. 91311

This department has been included since 1934 to provide a place for the registration of names of cultivated **Amaryllis** and other amaryllids on an international basis. The procedure is in harmony with the International Code of Botanical Nomenclature (edition publ. 1961) and the International Code of Nomenclature for Cultivated Plants (edition publ. 1958). Catalogs of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, **"Descriptive Catalog of Hemerocallis Clones, 1893-1948"** by Norton, Stuntz and Ballard was published in 1949. Additional catalogs of cultivars have been published since 1949: **Catalog of Brunsvigia Cultivars, 1837-1959,** by Hamilton P. Traub and L. S. Hannibal, PLANT LIFE 16: 36-62; 1960; Ad-

dendum. PLANT LIFE 17: 63-64. 1961; **Catalog of Hybrid Nerine Clones, 1882-1958,** by Emma D. Menninger, PLANT LIFE 16: 63-74. 1960; Addendum, PLANT LIFE 17: 61-62. 1961; **The Genus X Crinadonna,** by Hamilton P. Traub, PLANT LIFE 17: 65-74. 1961: **Catalog of Hybrid Amaryllis Cultivars,** 1799-1963, by Hamilton P. Traub, W. R. Ballard, La Forest Morton and E. Authement, PLANT LIFE. **Appendix** i-ii + 1-42. 1964. Other catalogs of cultivated amaryllids are scheduled for publication in future issues. These may be obtained at $7.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Jolla, Calif. 92037.

The registration activity of the American Plant Life Society was recognized when at the XVIth International Horticultural Congress, Brussels, 1962, the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for the cultivars of **Nerine;** and this was extended to include all the **Amaryllidaceae** cultivars, excepting **Narcissus** and **Hemerocallis,** at the XVIIth International Horticultural Congress, 1966.

Only registered named clones of **Amaryllis** and other amaryllids are eligible for awards and honors of the American Amaryllis Society at Official Amaryllis Shows.

Correspondence regarding registration of all amaryllids such as **Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis,** and so on, should be sent to Mr. Weinstock at the above address. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

REGISTRATION OF NEW AMARYLLIS CLONES, 1974

Registered by E. P. Adams, 3833 Denver, Corpus Christi, Texas 78411

Amaryllis clone **'Juanita'** (Adams, 1974); A-1001; U-4 fld; April; 25" h; perigone 3½" long, 8" across face, white flower with green throat and petal tips and margins brushed red. White portion without any markings. Evergreen, slight fragrance.

Registered by C. D. Cothran, 1733 N. Gibbs St., Pomona, CA 91767

Amaryllis clone **'Double Beauty'** (Cothran, 1974); A-1002; U-4 or 5 fld 18" h; 9" across face, white with pink veining along edges and tips, red picotee all segs. Vigor (2 scapes totaling 9 blossoms in second year of bloom), full double flowers, and lovely markings characterize this flower. Evergreen.

Registered by Mrs. Enoch Johnstone, 1016 Maxey Rd., Houston, Texas 77015

Amaryllis clone **'Beebe'** (Johnstone, 1974); A-1003; U-4 or 5 fld; 20" h; perigone 3½", 7" across face, vibrant true pink with seg edges a bit lighter, upper segs dark rose line near light green throat. Firm substance. white stamens, fragrant, and deciduous.

Amaryllis clone **'Grandeur'** (Johnstone, 1974); A-1004; U-3 to 4 fld; 22" h; perigone 2" long, 9" across face, blend of rose and white with light green throat, bottom seg almost white. Deciduous, fragrant, heavy-textured, light rose stamens.

Registered by Pearl H. Hammond, Route 1, Box 167, Angleton, Texas 77515

Amaryllis clone **'Nell Pickard'** (Hammond, 1974); A-1005; U-?; 28" h; perigone 1½" long, 9-10" across face, rose opal with dark throat. Upper seg more than 3" across, flower compact, round, and flat. Fragrant, spring bloomer, sheen, stamens same as flower.

Registered by Dr. John W. Hirschman, 752 Craycroft Rd., Tucson, Arizona 85711

Amaryllis clone **'Sweetheart'** (Hirschman, 1974); A-1006; U-4 fld; 22" h; perigone 2½" long, 7" across face, solid light red. Evergreen spring bloomer with perfectly flat face. Not fragrant.

GEOGRAPHICAL DISTRIBUTION OF THE **AMARYLLIDACEAE**

MARVIN ELLENBECKER, *151 S. Hanover St., Carlisle, Pennsylvania 17013*

This paper will attempt to show the worldwide distribution of the *Amaryllidaceae*. It is not possible to deal with the family at the specific level in this paper so the accompanying map depicts location at the tribal and generic level.

The *Amaryllidaceae* are a family of perennial bulbous herbs that are mostly tunicated bulbs with leaves from the base of the stem or apex of the bulb. The leaves are usually linear and the flowers are showy, bisexual, mostly zygomorphic, and solitary to many in the umbel at the top of the scape. The umbel has an involucre of one or more membraneous bracts. The flowers have six segments in two series of three and a corona is sometimes present. The six stamens are opposite the segments (tepals) or lobes of the perianth, are usually free but are sometimes modified to form teeth, scales on the filaments and may be partially united to form a staminal cup. The ovary may be superior or inferior and the fruit is a dry dehiscent capsule or can be a fleshy berry and indehiscent. The seeds are solitary, few to numerous in each fruit, and have a fleshy endosperm and are round, angular or more often wing (D)-shaped.

The family has had an interesting and somewhat perplexing history in the hands of the taxonomists. The more conservative approach was to look upon the *Amaryllidaceae* as simply an artificial division under the *Liliaceae* (those species with inferior ovaries were considered amaryllids). The 19th Century saw two definitive works written on the family, *Amaryllidaceae* by William Herbert (1837) and *Handbook of the Amaryllеae* by J. G. Baker (1888). Both works, though modified by later workers, established the majority of the then known genera to the species level. It was Hutchinson (1934) who finally broke with the traditional view of inferior vs. superior ovaries and considered all aspects of the organisms when classifying the *Amaryllidaceae*. Later workers studying the karyology of many of the genera have added more credulence to what Hutchinson did on the basis of gross morphology. This paper will take the newer approach and will be based on the key to the genera as described by Hutchinson (1934) and Traub (1963). There have been important revisions within the last 11 years and an attempt has been made to bring the family as a whole into its currently recognized status. Traub (1972) has removed the subfamily *Allioideae* and proposes that this group be recognized as the order *Alliales*. Traub (unpublished) is currently revising those genera placed in the subfamily *Ixiolirioideae* and *Leucocrinum* in the *Hemerocalloideae*.

The *Amaryllidaceae* presently consists of two subfamilies (*Hemerocalloideae* and *Amarylloideae*) with 16 tribes and 63 genera with a total of approximately 817 species.

Table 1 shows the family by tribes and lists the genera and number of species along with the known distribution of each genus. Figure 1 depicts the general vegetative areas of the world and the genera of the *Amaryllidaceae* appear on this map according to their distribution at the tribal level. By referring to the tribe number given on Table 1, the reader can quickly get an idea as to where that particular tribe is located by referring to that same number where it appears on the map. Table 2 deals solely with the distribution of the genus *Amaryllis*.

Rees (1972) deals at some length as to how bulbous plants (including the *Amaryllidaceae*) have dispersed in the various regions of the world in his book *The Growth of Bulbs*. Other references cited deal with the origins of several genera and reproduction and dispersal of plants in general with several amaryllids cited in particular.

ACKNOWLEDGEMENTS

The author expresses his appreciation to Dr. Peter Murphy and Dr. John Beaman, Department of Botany at Michigan State University, East Lansing, Michigan for their valuable criticisms in reviewing the original paper on distribution of the *Amaryllidaceae* and to Dr. Hamilton P. Traub for his corrections and suggestions on this condensed version of the paper.

TABLE 1. GENERA OF THE *AMARYLLIDACEAE* BY TRIBES

Family *Amaryllidaceae* Jaume St.—Hilaire

Subfamily 1. *Hemerocalloideae* Traub

Tribe 1. *Hemerocalleae* R. Brown

1. *Hemerocallis* R. Brown (17)
The 16 species are native to Asia especially the east central portion of the continent. Floral colors are primarily those which attract insect pollinators (yellow, pink and orange). The plants spread asexually by underground rhizomes forming large clumps. One additional species, *H. washingtonia* Traub is the first named colchicine-induced tetraploid species.

Subfamily 2. *Amarylloideae* Herbert

(Infrafamily I. *Amarylloidinae* Traub)

Tribe 2. *Traubieae* Moldenke

2. *Traubia* Moldenke (1). Native to Chile.
A single genus with one species comprises this tribe which is in the cool phase of the Austromalesian realm but bordering the dry phase of the Neotropical realm.

Tribe 3. *Zephyrantheae* Salisbury

3. *Rhodophiala* Pres. (33)
All were located in Central Chile and the western edge of Argentina until a new species was described by Ravenna (1970) in Minas Gerais State, Brasil.

4. *Haylockia* Herbert (3)
This genus was thought to have only one species but has now been found in Bolivia also.

5. *Pyrolirion* Herbert (10)
Endemic to Peru-Bolivia.

6. *Zephyranthes* Herbert (67)
The genus is found in both Central and South America (extending also into Texas and New Mexico and to the Atlantic Coast). The origin is debatable as to which area it spread to but more than likely it moved from some location in South America to Texas using Central America as a bridge. The taxonomy of this genus has been uncertain for years.

7. X *Sydneya* Traub (4)
An intergeneraic cross between *Zephyranthes* x *Habranthus* that indicates the closeness of the two genera.

8. *Habranthus* Herbert (23)
The same geographical distribution as for *Zephyranthes* except not found in southeast U.S. Both also occur in the West Indies.

9. X *Rhodobranthus* Traub (2)
Rhodophiala x *Habranthus* cross.

10. *Sprekelia* Heist. (2)
Native to Mexico, Central America and extending into South America.

11. X *Sprekanthus* (1)
Sprekelia x *Habranthus* cross.

12. *Famatina* Ravenna (3)
Newly recognized genus (1972) located in Central Chile and western part of Argentina.

Tribe *Zephyrantheae* has had considerable taxonomical rearranging and is still undergoing revisions and additions. Species described in the past have been lost or were improperly keyed. Perhaps because they bloom quickly after a rainstorm and then set seed and disappear as dry weather follows, has been the main obstacle to matching the leaves with the flowers. The tribe is confined exclusively to the New World.

Tribe 4. *Amarylleae* Endlicher

13. *Worsleya* Traub (1)
Endemic only to the Organ Mts. (Brasil) near the city of Petropolis. Traub says it evolved from common ancestral stock with *Amaryllis* L. but due to a long period of isolation, the two are now incompatible. *W. rayneri* has lilac flowers and a long aerial-necked bulb.

14. *Amaryllis* L. (76)
This genus which has been used so extensively as a showy ornamental

is discussed in great detail in Traub's *The Amaryllis Manual* (1958). When that work was published the number of species totaled 46. This indicates the wide diversity of the genus in many of the previously unexplored parts of South America. The 76 species have been pinpointed on the map and correspond with the numbers given in Table 2.

15. *Placea* Miers ex Lindley (6)
All species are endemic to Chile.

Tribe 5. *Lycoreae* (Traub and Moldenke) Traub

16. *Ungernia* Bunge (8)
The distribution center is in central Asia but one species is supposedly found also in Japan. The latter is based on one herbarium specimem and since no other known endemic plants of Turkestan are found in Japan this species is questionable.

17. *Lycoris* Herbert (18)
This genus is confined to eastern Asia, extending from Japan and Korea southward to upper Burma.

Tribe 6. *Narcisseae* Endlicher

18. *Sternbergia* Waldest. & Kit. (5)
Confined to the Mediterranean region, Asia Minor and Iran.

19. *Narcissus* L. (22)
Although the genus is found primarily in the Mediterranean region, it extends to the Canary Islands, Asia Minor, Kashmir and into China and Japan.

20. *Tapienanthus* Herbert (1)
Strictly endemic to Spain and Morocco.

The tribe *Narcisseae* lies between latitude 23° N. and 45° N. and appears to have an east-west distribution. Several or perhaps the majority of species are autumn and winter flowering types. This is due to their adapting to a climate which has its rains in the winter months and long periods of hot, dry months. Their habitat lies in an area where the wet-dry cycle and warm-cold cycle intermingle.

Tribe 7. *Galantheae* Salisbury

21. *Lapiedra* Lagasca (1)
Endemic to the eastern and southern part of Spain and to Spanish Morocco (International Zone of Tangiers).

22. *Hannonia* Braun-Blanq. & Marie (1)
Morocco in the area of the Promontory of Hercules and the Atlantic Ocean.

23. *Leucojum* L. (11)
Mediterranean region into Asia Minor and Iran.

24. *Galanthus* L. (13)
Mediterranean region of the world into Asia Minor and the region of Georgia S.S.R.

Tribe 8. *Crineae* (Pax) Traub

25. *Ammocharis* Herbert (5)
South to northeastern area of southern Africa.

26. *Crinum* L. (130)
The most cosmopolitan genus of the *Amaryllidaceae* with the greatest number of species. Almost all species are confined to littoral, island and marsh or stream locations.

27. X *Crinodonna* Region ex Traub (3)
Brunsvigia x *Crinum* hybrid producing sterile offspring.

28. *Nerine* Herbert (41). South Africa.

29. X *Brunsnerine* Traub. *Nerine* x *Brunsvigia*.

30. *Boophone* Herbert (2). Cape Province, South Africa.

31. *Cybistetes* Milne-Redhead Schweickert (1). Cape Province, South Africa.

32. *Brunsvigia* Heist. (17). South Africa to Tanzania.

33. *Carpolyza* Salisbury (1). Cape Province, South Africa.

34. *Strumaria* Jacques (7). South Africa.

35. *Hessea* Herbert (15). South Africa.

The tribe *Crineae* is endemic to the southern part of Africa with the exception of *Crinum*, a cosmopolitan genus. The seed dispersal of *Crinum* will be discussed later in this article.

Tribe 9. *Cyrtantheae* Salisbury

36. *Anoiganthus* Baker (2). South Africa.

37. *Cyrtanthus* Aiton (45). South Africa, Angola and Tanzania.

Tribe 10. *Clivieae* Traub

38. *Clivia* Lindley (4). South Africa.

39. *Cryptostephanus* Baker (5)
Namagualand, Southern Rhodesia, Angola and Southwest and East Africa.

The *Cyrtantheae* and *Clivieae* tribes are found only in Africa.

Tribe 11. *Haemantheae* Salisbury

40. *Haemanthus* L. (77). South Africa to Tropical Africa.

41. *Choananthus* Rendle (2). East Africa.

Tribe 12. *Gethylleae* Salisbury

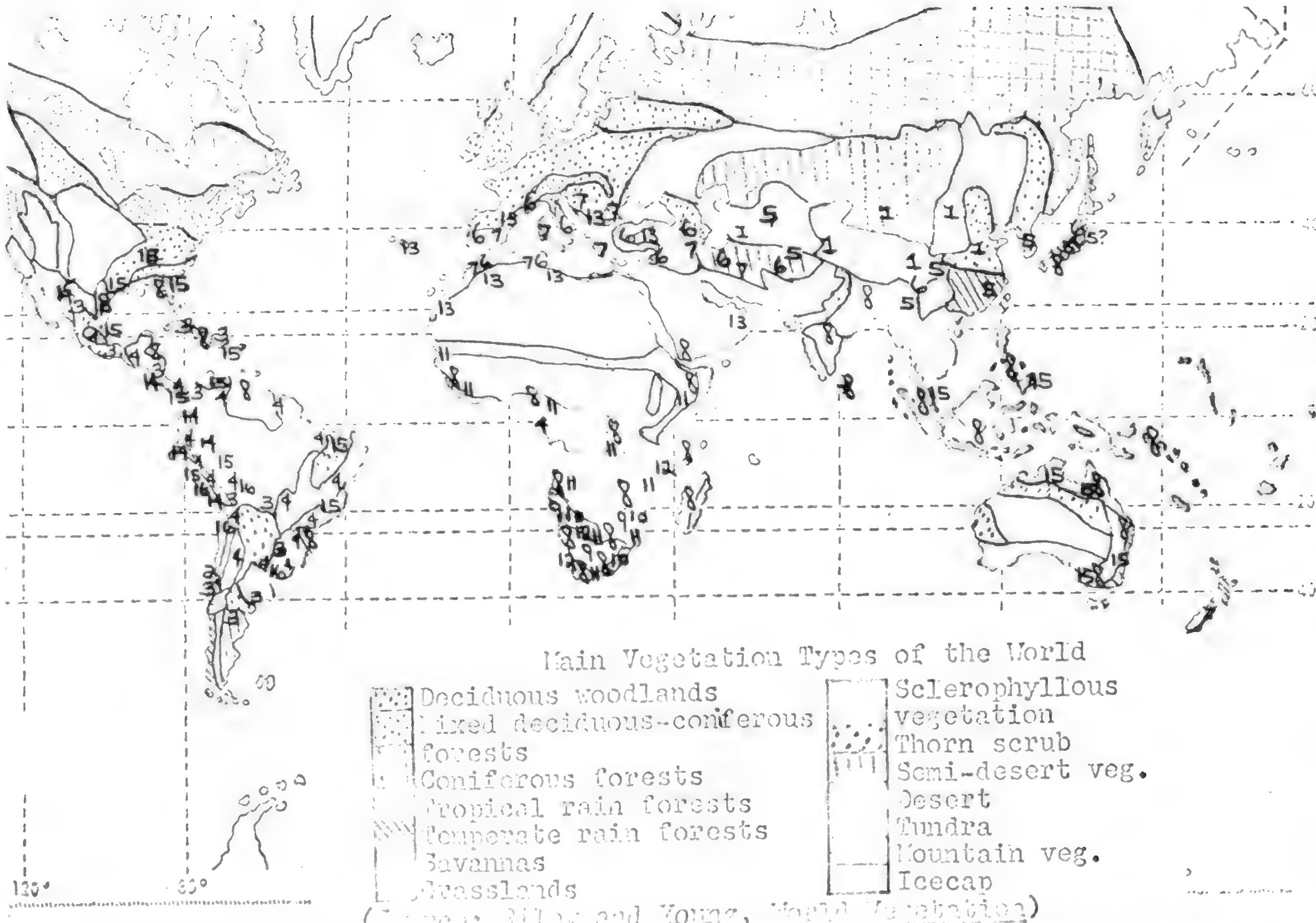
42. *Gethyllis* L. (21). South Africa.

43. *Apodolirion* Baker (2). East Africa.

44. *Klingia* Schoenland (1). Namaqualand.

Both the *Haemantheae* and *Gethylleae* are confined to Africa, the majority of the species being found in the southern half of the continent.

(Infrafamily II. *Pancratioidinae* Traub)



[illegible] of the Amaryllidaceae; range of genera is indicated by the numbers preceding genera listed in the text.

Tribe 13. *Pancraticae* Salisbury

45. *Vagaria* Herbert (1) Asia Minor.

46. *Pancratium* L. (21)
Native to the Mediterranean rim to Asia Minor, Oman, Canary Islands, northern Africa to South Africa and into Tropical Asia. This genus has a counterpart in the New World, *Hymenocallis*.

47. *Chapmanolirion* Dinter (1). South-West Africa.

Tribe 14. *Stenomesseae* Traub

48. *Rauhia* Traub (1)
Jaen, Peru. The genus *Rauhia* remains unchanged because the General Committee on Botanical Nomenclature has voted that *Rauhia (Amaryllidaceae)* and *Rauia (Rutaceae)* should not be treated as variants under Article 75 of the Code.

49. *Stenomesson* Herbert (26)
Ecuador, Peru, Bolivia and northern Chile.

50. *Pamianthe* Stapf (2)
Temperate Zone of northern Central Peru. One of two species, *P. cardenasii* Traub, is an epiphyte.

51. *Paramongaia* Valarde (1). Ancash Dept., Peru.

52. *Phaedranassa* Herbert (8). Andes of Peru, Ecuador, Colombia to Costa Rica.

53. *Eucrosia* Ker-Gawler (4). Andes of Peru and Ecuador.

The tribe *Stenomesseae* is confined to the northwestern part of the South American continent and into Central America. Perhaps the orographic influence of the Andes has been responsible for the evolution of the several genera.

Tribe 15. *Euchareae* (Pax) Traub *(Urceolineae?)*

54. *Griffinia* Ker-Gawler (11)
Southern, eastern and central areas of Brasil.

55. *Urceolina* Reichb. (28)
Former genus *Eucharis* has been reduced to a subgenus of *Urceolina* so the range now is from Peru, Bolivia, Brazil and Colombia to Panama and Costa Rica.

56. *Hymenocallis* Salisbury (64)
A widely distributed genus ranging from the southeastern and south-central United States and Mexico through Central America to Peru and Venezuela in South America and in the islands of the West Indies.

57. *Eurycles* Salisbury (2)
Malay Peninsula, Philippines and northern Australia.

58. *Calostemma* R. Brown (3)
Endemic to Australia and found in New South Wales, South Australia, Queensland and the Northern Territory along the Gulf of Carpentia.

The *Euchareae* should be referred to as Tribe *Urceolineae* as *Eucharis* is now a subgenus of *Urceolina*.

Tribe 16. *Eustephieae* (Pax) Traub.

59. *Phycella* Lindley (7)
Peru, Chile, Argentina and Uruguay.

60. *Eustephia* Cav. (8)
Includes the genus *Eustephiopsis* now reduced to a subgenus—Peru. Argentina and Bolivia.

61. *Castellanoa* Traub (2). Argentina and Bolivia.

62. *Chlidanthus* Herbert (4). Mexico to Bolivia and Chile.

63. *Hieronymiella* Pax (1). Argentina.

The *Eustephieae* tribe seems to cluster mainly in central South America in areas of mountain vegetation, thorn scrub and grasslands. *Chlidanthus* has the greatest range.

In an attempt to correlate geographical distribution of the family to main world vegetation types, Figure 10 is used to illustrate the vegetation types. Members of the *Amaryllidaceae* occur with all vegetation types except the tundra and icecap. They would appear to be concentrated for the most part in the tropical rain forests, savannas and grasslands.

TABLE 2. DISTRIBUTION OF GENUS *AMARYLLIS*, TRIBE *AMARYLLEAE*

General range: Mexico and West Indies through Latin America to Argentina and Chile with one species extending to Prince's Island in West Central Africa. The majority are endemic to the great Rio Amazonas basin of Brasil, Bolivia and Peru, which is probably the center of species dispersal. Specific species and habitat locations are given and the abbreviated references are as follows: Traub = Traub, Hamilton P. 1958. *The Amaryllis Manual.* New York: The MacMillan Company.; *P.L.* = *Plant Life.*

1. *immaculata* (Traub & Moldk. syn. *A. argentina*); Tucumán Province, Argentina [Traub, p. 264; see also *P.L.* 26:53 (1970) and *P.L.* 28:11-12 (1972)]

2. *A. tucumana* (Holmb. T & U.; Tucumán Province (Salta), Argentina [Traub, p. 264; *P.L.* 26:53 (1970) and *P.L.* 28:11-12 (1972)]

3. *A. viridiflora* (Rusby) T. & U.; Manchuriza, Bolivia at alt. 1,067 meters; specimen only [Traub, p. 265; *P.L.* 16:36 (1960)]

4. *A. elegans* Sprengel; Five varieties from Northern Brasil. Guiana, Venezuela, Colombia, Peru and Ecuador (Traub, p. 265-267)

5. *A. vittata* L'Hérit.; Peru and Brazil with two varieties (Traub. 267-268)

6. *A. breviflora* (Herb.) Sweet; Campodo Massiambú and Palhoca. Santa Catarina State, Brasil (Traub, p. 269)

7. *A harrisonii* Lindl; Uruguay (Traub, p. 269)

8. *A. canterai* (Arech.) T. & U.; Rivera Dept., Region of Tanqueras, Uruguay (Traub, p. 270)

9. *A. damaziana* (Beauv.) T. & U.; Plateau of l'Itaculumi, Minas Geraes State, Brasil (Traub, p. 270)

10. *A. aglaiae* Castellanos; Salta and Jujuy, Tucumán Province.

Argentina (Traub, p. 271)

11. *A. striata* Lamarck; Four varieties found in southern and central Brasil (Traub, p. 271-273)

12. *A. crociflora* (Rusby) T. & U.; Guerratuma River, alt. 1,067 meters, Bolivia (Traub, p. 273)

13. *A. flammigera* (Holmb.) T. & U.; Misiones, Santa Ana Province, Argentina (Traub, p. 274)

14. *A. maracasa* Traub; Monte de Burro, municipio Maracas (alt. 9,296 meters), Bahia State, Brasil (Traub, p. 274)

15. *A. angustifolia* (Pax) T. & U.; Monte Agudo and San Pedro, Misiones, Argentina (Traub, p. 275—Mr. J. L. Doran says these villages do not exist but the species is found 30 km. south of St. Tomé)

16. *A. petiolata* (Pax) T. & U. (syn. A. argilagae); Monte Justo, Santo Tome Dept., Corrientes Province, Argentina (Traub, p. 275)

17. *A. leopoldii* T. Moore; Andes of Peru (Traub, p. 276)

18. *A. stylosa* (Herb.) Sweet; Guiana and Maranhao in northern Brasil (Traub, p. 277)

19. *A. scopulrum* (Baker) T. & U.; Sorata in the Andes of Bolivia (temperate region at 2,438-2,743 meters) (Traub, p. 277)

20. *A. reginae* L.; Mexico, West Indies to Venezuela, Brasil, Peru, Bolivia and West Central Africa. Collected in thick, shady primitive woods, alt. 930-1,219 meters on Prince's Island in the Congo Estuary (1853) with the collector noting it "seems thoroughly spontaneous and even indigenous; not cultivated anywhere in the island and not seen in the less elevated districts". This particular species is puzzling because of the great range in which it is found. (Traub, p. 277)

21. *A. andreana* (Baker) T. & U.; Rio Cauca, alt. 1,524-2,438 meters in central cordilleras of Colombia (Traub, p. 278)

22. *A. miniata* R. & P.; Andes of Peru (Traub, p. 279)

23. *A. evansiae* Traub & Nelson; Between Santa Cruz and Cochabama Depts., Bolivia (Traub, p. 279)

24. *A. espiritensis* Traub; Santa Teresa, alt. 900 meters in Espirito Santo State, Brasil (Traub, p. 280)

25. *A. vanleestenii* Traub; Paramaribo, (Traub, p. 281)

26. *A. ferreyrae* Traub; Forest area on Isla Santa Maria, near Yurimaguas, Huallaga Valley, Loreto Dept., Peru (Traub, p. 281)

27. *A. belladonna* L.; Four varieties ranging from Mexico and the West Indies to Chile, Bolivia, Brasil and found in British Guiana, Guadeloupe, Colombia, Costa Rica and is often confused with the Cape Belladonna, *Brunsvigia rosea*. This has led some workers to classify *Brunsvigia* as *Amaryllis* and *Amaryllis* as *Hippeastrum* which is incorrect. (Traub, p. 282-284)

28. *A. barbata* (Herb.) Traub; Suriname (Traub, p. 284)

29. *A. barreirasa* Traub; Confluence of the upper Rio Grande and Rio Ondas near Barreiras in Bahia State, Brasil (Traub, p. 285)

30. *A. traubii* Moldk.; Pucayacu near Tarapoto in San Martin Dept., Peru [Traub, p. 286; Doran gives more exact location in *P.L.* 29:27-29 (1973)]

31. *A. apertispatha* Traub; Cachoeiro de Itapemitim on granite rocks at alt. 366 meters, Espirito Santo State, Brasil (Traub, p. 286)

32. *A. mandonii* (Baker) T. & U.; Sorata in the Andes of Bolivia (temperate region, alt. 2,438-2,743 meters) [Traub, p. 287; altitude is corrected in *P.L.* 28:15-16 (1972)]

33. *A. fosteri* Traub; Amargosa at alt. 315 meters in Bahia State, Brasil (Traub, p. 288)

34. *A. calyptrata* Ker-Gawl.: Moist forests of Serra do Mor in southern Brasil north to Organ Mountains of Rio Janiero State and into Espirito Santo State, Brasil. It is an epiphytic species which mimics a green orchid (Traub, p. 288-289)

35. *A. kromeri* Worsley; Upper San Francisco River in Minas Geraes State, Brasil (Traub, p. 290)

36. *A. psittacina* Ker-Gawl.; Two varieties are found in southern Brasil and on the borders of Sao Paulo and Minas Geraes States (Traub, p. 290)

37. *A. correiensis* Bury; Two varieties found in the Organ Mountains, Brasil (Traub, p. 291)

38. *A. aulica* Ker-Gawl.; Central Brasil to Paraguay (Traub, p. 292)

39. *A. forgetii* (Worsley) T. & U.; Limatambo in Cuzco Dept., Peru (Traub, p. 292)

40. *A. oconequensis* Traub; Oconeque, eastern cordillera of Puno Province in south-eastern Peru (Traub, p. 293)

41. *A. moreliana* (Lemaire) Traub; Brasil—exact location unknown (Traub, p. 293; Doran has collected it on Mt. Atibaia, Estado São Paulo)

42. *A. pardina* Hook. f.; Andes of Peru (location unknown) (Traub, p. 294; Doran say Peru is wrong and this species is found in Apolo, Dept. Caupalacon, Bolivia)

43. *A. fusca* (Kraenzl.) T. & U.; In shrubbery between Sandia and Curyocuyo at alt. 762 meters, Peru (Traub, p. 294; Doran says also at Pampaccahua on railroad north of Cuzco 94-98 km.)

44. *A. cybister* (Herb.) T. & U.; Andes of Bolivia (Traub, p. 295; Doran says the Sao Paulo, Brasil location that Traub refers to is *A. angustifolia* not this species)

45. *A. reticulata* L'Herit.; Two varieties in southern Brasil (Traub, p. 296)

46. *A. blumenaria* (C. Koch & Bouché ex carr.); Ilha de Santa Catherina and wet meadows in Santa Catherina State, Brasil (Traub, p. 297)

47. *A. minasgerais* Traub; Santa Terezinha, municipio Ituiutaba, Minas Gerais State, Brasil [*P.L.* 14:30 (1958)]

48. *A. paranaensis* Traub; Parana and Jaquariahyua, Brasil [*P.L.* 14:31 (1958)]

49. *A. santacatarina* Traub; Burned over bog at alt. 900-1,000 meters west of Cacador Taquara Verde; Municipio Cacador, Santa Catarina State, Brasil [*P.L.* 14:32 (1958)]

50. *A. mollevillquensis* Cardenas; Mollevillque in Potosi Dept. of Bilboa Province, Bolivia [*P.L.* 18:29 (1962)]

51. *A. fragrantissima* Cardenas; Yungas of Corani, Chapare Province, Bolivia [*P.L.* 16:32 (1960)]

52. *A. starkii* Nelson & Traub; Santiago, Bolivia [*P.L.* 19:37 (1963)]

53. *A. chionedyantha* Cardenas; Antahiucana to Rio Salta in Cochabamba Dept., Carcasco Province, Bolivia [*P.L.* 19:40 (1963)]

54. *A. umabisana* Cardenas; Umabisa in Cocabama Dept., Bolivia [*P.L.* 21:53 (1965)]

55. *A. incachacana* Cardenas; Incachaca in Cochabamba Dept., of Chapare Province, Bolivia [*P.L.* 21:55 (1965)]

56. *A. pseudopardina* Cardenas; Yungas near Corani in Cochabamba Dept. of Chapare Province, Bolivia [*P.L.* 21:55 (1965)]

57. *A. yungacensis* Cardenas; Solecama River, La Paz Dept. in Sud Yungas Province, Bolivia [*P.L.* 21:57 (1965)]

58. *A. escobaruriae* Cardenas; Yungas of La Paz, Bolivia [*P.L.* 25:41 (1969)]

59. *A. monantha* Rav.; Serra de Natividade, Goiás State and municipio Balsas in southern Maranhão, Brasil [*P.L.* 25:69 (1969)]

40. *A. restingensis* Rav.; Restinga near Yacarepagua, Guanabara, Brasil [*P.L.* 25:70 (1969)]

61. *A. papilio* Rav.; Santa Catarina State, Brasil [*P.L.* 26:83 (1970)]

62. *A. araripina* Rav.; Araripina, Pernumbuco State, Brazil [*P.L.* 26:84 (1970)]

63. *A. nelsonii* Cardenas; Rio Tumo Basin, 750 meters in La Paz Dept., Caupolican Province, Bolivia [*P.L.* 27:36 (1971)]

64. *A. doraniae* Traub; Island estuary of Rio Orinoco, Venezuela [*P.L.* 29:43 (1971)]

65. *A. blossfeldiae* Traub & Doran; Mogi das Cruzes, 50 km. east of Sao Paulo, municipio Ubataba, Maranduba Dist. Praia do Sape, Brasil [*P.L.* 27:44 (1971)]

66. *A. iguazuana* Rav.; Iguana National Park, Argentina and Parana State, Brasil [*P.L.* 27:63 (1971)]

67. *A. rubropicta* Rav.; Municipio Rio Blanco do Sul Santaria, Parana State, Brasil [*P.L.* 27:65 (1971)]

68. *A. anzoldoi* Cardenas; Yatibigua Canion from Charagua to Camiri, 800 meters in Santa Cruz Dept., Cordillera, Bolivia [*P.L.* 28:48 (1972)]

69. *A. divijulianus* Cardenas; Penon do San Julian near Tablas, alt. 1,800 meters in Cochabamba Dept., Chapare Province, Bolivia [*P.L.* 28:49 (1972)]

70. *A. caupolicanensis* Cardenas; Convent of Apolo, alt. 1,400 meters in La Paz Dept., Caupolican Province, Bolivia [*P.L.* 28:50 (1972)]

71. *A. neoleopoldii* Cardenas; Tumo River, alt. 1,200 meters in La Paz Dept., Caupolican Province, Bolivia [*P.L.* 28:52 (1972)]

72. *A. lapacensis* Cardenas; Puente Villa, alt. 1,700 meters in La

Paz Dept., Sud Yungas Province, Bolivia [*P.L.* 28:54 (1972)]

73. *A. leopoldii* forma *Whitakeri* Cardenas; Penon de San Julian, alt. 2,000 meters in Cochabama Dept., Chapare, Province, Bolivia [*P.L.* 29:36 (1973)]

74. *A. paquichana* Cardenas; Paquicha, Machariapare River at alt. meters in La Paz Dept., Caupolican Province, Bolivia [*P.L.* 29:38 (1973)]

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LATIN AMERICAN AMARYLLIDS, 1974

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[The present is the translation from the writer's recent articles on *Amaryllidaceae* and *Alliaceae*. Due to the limited space in this department, unnecessary paragraphs, such as introductions and others, are not included].

PUCARA, a new genus of Amaryllidaceae from North Peru; in An. Mus. Hist. Nat. Valparaíso 5:85-89, 1972.

Flowers regular ascending. *Ovary* inferior, trilocular, bearing many, superposed ovules. *Perigone* funnel-shaped, white. *Tepals* lanceolate or oblong-lanceolate, rather concrescent toward the base, the outer series minutely apiculate. *Staminal cup* deeply trilobed, the lobes bifid, crenate. *Filaments* filiform, the episepal very short, inserted on the very base of the cup, the epipetal longer, arising from the bifid part of the cup lobes. Anthers linear, erect fixed to the filaments in the lower third. *Style* filiform much surpassing the stamens. *Stigma* shortly trifid, its lobes recurvely spreading.

Bulbous vivaceous plants. Bulb subglobose covered by several, fragile, brownish coats; pseudoneck short. Leaves lanceolate or linear-lanceolate, subserotine, folded outwards in prefoliliation. Scape cylindrical, solid. Spathe bivalved; valves membranous, marcescent, free to the base. Inflorescence many-flowered.—Type-species: *Pucara leucantha* Ravenna.

A single species from the Departments of Cajamarca and Amazonas, in North Peru. The name *Pucara* (pronounced Pucára), has been adopted from the Ckechua term, which means a fortified place. It refers to the locality near the place where the species was found.

Generic relationships.—The inflorescence of *Pucara* suggests a relationship with *Rahuia*, a genus which inhabits the same region. Notwithstanding, the latter has thick, almost coriaceous leaves, and its flowers are quite different. On the other hand, only three genera exist in Peru with a trifid stigma; these are: *Amaryllis*, *Chlidanthus*, and *Zephyranthes;* they all differ, in every respect, from *Pucara*. Our genus shows some resemblance also with *Stenomesson*, but the morphology of perigone, androecium, and stigma, show fundamental differences. *Pucara* is placed in the tribe *Eustephiae;* the latter will be treated in a future work.

Pucara leucantha Ravenna, An. Mus. Hist. Nat. Valparaíso 5:86, 1972.

Plant about 15-50 cm high. *Bulb* globose or subglobose, 37-47.5 mm wide, with a 25-40 mm long pseudo-neck; outer tunics several, membranous, corrugated, brown. *Leaf* lanceolate or linear-lanceolate, acute, folded outward in prefoliation, not petioled (?), often solitary and not completely developed at anthesis, to 10-12 cm long, 20-30 mm, or more, broad. *Scape* cylindrical about 15-50 cm long, 5 mm broad at the apex. *Spathe* bivalved; valves lanceolate, membranous, marcescent,

subequal, free to the base, to 25-31 mm long; inner bracts very small, lanceolate. *Inflorescence* many-flowered. *Pedicels* ascending, about 3-6 mm long. *Flowers* white, funnel-shaped, about 12-14 mm in diameter. *Ovary* oblong-elliptic, to 3.8-4 mm long, 1.5-2 mm broad. *Tepals* lanceolate or oblong-lanceolate, concrescent for 4.5 mm; the outer 12-14 mm long, 4 mm broad, with a diminutive apicule; the inner 14 mm long, 5 mm broad. *Staminal cup* about 6.5 mm long, splitted in three lobes for 5-5.3 mm of its length; lobes notched, somewhat concave in the inner face, bifid for 2 mm. *Filaments* biseriate, the episepal 0.4 mm long, inserted on the very base, in the inside, of the staminal cup; the epipetal 1.8-2 mm long, arising from the bifid part of the cup lobes. *Anthers* linear, erect, to 3.6-5.8 mm long; pollen yellow. *Style* filiform, erect, 19.2-20 mm long. *Stigma* shortly trifid, its lobes linear, spreading but slightly recurved. *Immature capsule* globose-tricoccous. *Immature seeds* compressed, circular.

Range and habitat.—A native of North Peru. It grows on rocky slopes and sandy places of the Departments of Cajamarca and Amazonas, at about 990-1,650 m of altitude.

The specific epithet is formed by the greek terms *leuco*, white, and *anthos*, flower, alluding to the white flowers.

The discovery of this species shows the kind of oddities that are still hidden in certain less explored regions of Peru. Although its flowers are not very showy, the plant could be a worthy object for the bulb growers.

Contributions to South American Amaryllidaceae V; in Notic. Mens. Mus. Hist. Nat. Santiaga 189: 8, 1972.

1. **Habranthus schulzianus** Ravenna, Notic: Mens. Mus. Hist. Nat. Santiago: 8, 1972

Plant about 15-16 cm high. *Bulb* widely ovoid, 25-44 mm long, 23-26 mm in diameter, prolonged into a 17 mm long pseudo-neck and covered by brown, membranous coats. *Leaves* 1-2, present at anthesis, narrowly linear, to 6.5-11.5 cm long, 1.2-2 mm broad. *Scape* about 7.7 cm long (in the dry specimen). *Spathe* one-flowered, membranous, tubular for 26-27 mm, then bifid for 9 mm. *Pedicel* 35 mm long. *Ovary* obovate-oblong, about 6.5 mm long, 2 mm broad. *Flower* white, 38-43 mm long. *Tepals* oblanceolate, joined at the base for 2.8 mm, about 40 mm long, 6-7 mm broad. *Filaments* declined, the upper episepal to 9.8-11 mm long, lateral episepal 12.5-13 mm long, lower epipetal 14.5-16 mm long, lateral epipetal 18-18.8 mm long. *Anthers* about 5-6.5 mm long. *Style* declined to 24 mm long. *Stigma* lobes 4-4.2 mm long. *Capsue* globose, subtricoccous, about 11 mm in diameter. *Seeds* oval or broadly elliptic, black, to 4.3-4.8 mm long.

Habitat.—Chaco region, in the north-west of the province of Santa Fe, Argentina.

This species rather resembles to *Habranthus salinarum* Rav.; it differs, however, in its wider perigone, and in the longer stigma lobes.

The specific epithet was given in honor of Dr. Augusto Schulz, of

the Colonia Benitez Agricultural Station, province of Chaco (Argentina). Dr. Schulz has collaborated very much in the collection of critical material of the genus *Habranthus*. His sendings of living plants have been of much help.

II. The correct name of a **Zephyranthes** species

Zephyranthes americana (Hoffmsgg.) Ravenna, Notic. Mens. Mus. Hist. Nat. Santiago: 8, 1972.—*Sternbergia americana* Hoffmansegg, Verz. Pfl.: 197, 1824.—*Haylockia pusilla* Herbert, Edwards Bot. Reg. 16: tab. 1371, 1830.—*Zephyranthes pusilla* (Herb.) Dietrich, Syn. Pl. 2: 1176, 1840.—*Haylockia americana* (Hoffmsgg.) Herter, Estud. Bot. (Fl. Urug. VII-VIII): 224, 1956.

Recently (Ravenna 1971), I expressed the view that *Haylockia* be considered as a subgenus of *Zephyranthes*. In that work, I used the name *Z. pusilla* (Herb.) Dietr. for the type-species. Lately, however, I learned about the existence of a previous name in *Sternbergia*, a genus of the Old World.

Studies in the *Alliaceae*: in Notic. Mens. Mus. Hist. Nat. Santiago 198, 1973.

Nothoscordum entrerianum Ravenna, loc. cit. [Fig. 11]

Plant 15-31 cm high. *Bulb* ovoid or globose-ovoid, 27-28 mm long, 12-13 mm in diam., with a slight alliaceous smell, covered with a few, dry, pale brown coats; basal corm large; bulblets 3-5, probably more among the tunics, ovate-fusiform, a pale or dark brown, 6-6.8 mm long, 3.4-3.5 mm in diam. *Leaves* more or less prostrate, flaccid, a pale green, rather carinate and channelled, subobtuse, about 15-24 mm long, 3.7-6 mm broad, narrower toward the apex. *Scape* weak, to 28 cm long, 1.7-2.6 mm near the base. Inflorescence 7-10-flowered. *Spathe valves* marcescent, subequal, 6-7 mm long, joined at the base. *Pedicels* 13-16.5 mm long, when they bear flowers. *Flowers* infundibulate, erect or subereet, 7-7.5 mm long, 7.5-8.5 mm in diam., very fragrant, white, not purple-stripped, green at the concrescent part of tepals. *Tepals* lanceolate, joined for 1-1.2 mm, about 7 mm long; the outer 2.9 mm broad, subacute; the inner 2.2 mm broad, almost obtuse. *Filaments* narrowly lanceolate, narrowing gradually upwards, greenish near the base, white above; the episepal about 4.5 mm long, 0.9 mm broad at the base; the epipetal ca. 5.2 mm long. *Anthers* oblong or oblong-elliptical, versatile, 1.7 mm long before dehiscence, 0.7-0.9 mm long after it; *pollen* sulphur yellow. *Ovary* widely elliptical, almost tricoccous, a bright green, about 2.3 mm long, 1.8 mm in diam. *Style* filiform, white, about 3.2 mm long. *Stigma* capitate.

Hab.—Ravines above the Paraná river, near Hernandarias, in the province of Entre Ríos, Argentina. It grows in sandy clay.

Allied to *N. arenarium* and to *N. nudicaule* (see Guaglianone 1972,

Fig. 11. **Upper Nothoscordum serenense** Rav.; and **Lower, N. entre-raianum** Rav. Photos by P. Ravenna.

p. 209), but readily recognizable by virtue of its small habit, and by the tepals not streaked with purple.

Apparently endemic in the ravines above the banks of the Paraná river, in the western side of the province of Entre Ríos.

In the fourth series of my "Contributions to South American *Amaryllidaceae*", the epithet *balaenense*, [See Fig. 12] which heads the original description of the species in *Nothoscordum* (See Ravenna 1971, p. 85), was misprinted.

Nothoscordum serenense Ravenna, in Notic. Mens. Mut. Hist. Nat. Santiago 198, 1973. [Fig. 11.]

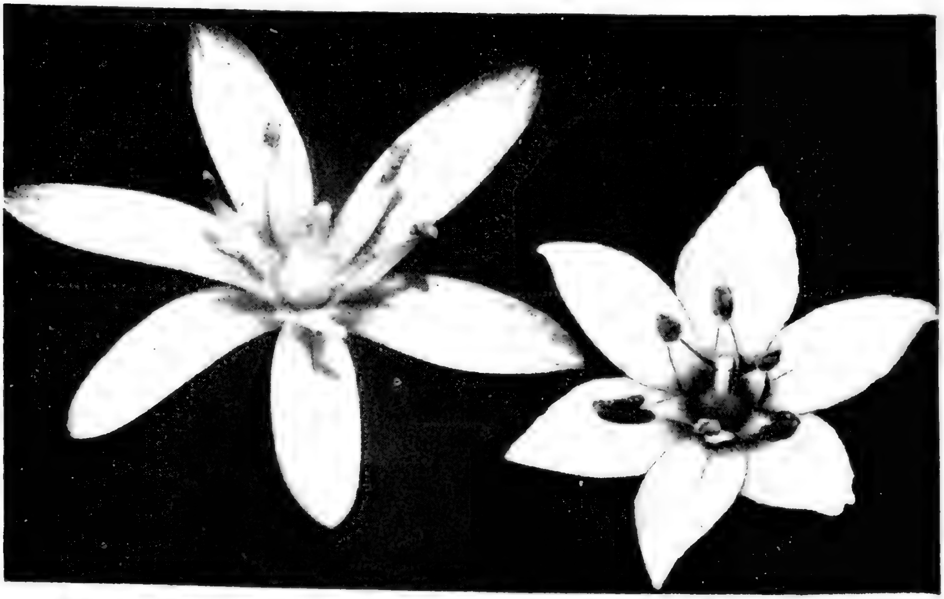

Fig. 12. **Left, Nothoscordum nublense** Rav., and **right, N. balaenense** Rav. Photos by P. Ravenna.

Plant 30-45 cm high. Bulb ovoid or broadly ovoid, very bulbiliferous, 15-20 mm long, 9-19 mm in diam., prolonged into a 20-27 mm long pseudo-neck; outer coats membranous, fragile, a pale brown or whitish in nature, tinged purple after dried; basal corm small. *Leaves* 1-3, synanthious, linear, rather fleshy, moderately channelled, 9-21 mm long, 1-2.5 mm broad. *Scape* 22-33 cm long, 1.3-2.5 mm broad, an ashy green, pruinose. *Inflorescence* 3-12 flowered. *Spathe valves* lanceolate, marcescent, 5-10 mm long, joined at the base for 1-2 mm. *Pedicels* slender, 22-35 mm long, 0.4 mm broad. *Flowers* widely funnel-shaped,

8-9 mm long, 13-16 mm in diameter. *Tepals* whitish, with a difuse brownish-green streak in both outer and inner faces, lanceolate-elliptic, subequal, with a cucullate-concave apex; the outer acute, ca. 4 mm broad; the inner 3.8-3.9 mm broad. *Filaments* free, a dirty green, lanceolate-subulate, thickened, not complanate, narrowed in the lower forth; the outer 5.5 mm long; the inner 5.9 mm long. *Anthers* reniform after dehiscence, 1.3-1.4 mm long; *pollen* orange. *Ovary* elliptical, 2.2 mm long, 1.4 mm in diameter. *Style* 4.7 mm long, filiform, greenish at the base whitish above. *Stigma* capitate.

Hab.—Sandy hills near La Serena, and also at Salala, where the road from Ovalle joins the Panamerican highway. In the former place, it grows near *Leucocoryne coquimbensis*, *Sisyrinchium graminifolium* ssp. (Irid.), *Conanthera campanulata*, and Nolanaceae. Some of the *Nothoscordum* plants were here parasitized by *Cuscuta* sp. In the latter location, it was found near *Rhodophiala bagnoldii* and *Alstroemeria recumbens* Herb. (yellow form).

Nothoscordum serenense can be distinguished, from the rest of the species, on account of the cucullate apex of tepals. It is a very distinct species.

According to Mr. Carlos Jiles, who knows much on the flora of Coquimbo, it is quite common in the region of Ovalle, the town where he lives.

Nothoscordum nublense Ravenna, in Notic. Mens Mus. Hist. Nat. Santiago 198, 1973. [Fig. 12.]

Plant 10-30 cm high. *Bulb* ovate or subglobose, about 15-20 mm long, 13-18 mm wide, covered by whitish or brownish, rarely blackish coats; bulbiles whitish, ovoid or almost globose, 2.8-4 mm long; basal corm small; the pseudo-neck 10-35 mm long. *Leaves* present at anthesis, narrowly linear, thickened, moderately channelled but not carinate, a dark green, to 10-20 cm long, 1-2.5 mm broad. *Scape* pale green, 10-25 cm long, 1.3-2.3 mm broad. *Inflorescence* 3-7 flowered. *Spathe-valves* lanceolate, membranous, joined at the base for 2-2.5 mm, 13-15 mm long. *Pedicels* 15-30 mm long. *Flowers* widely funnel-shaped or often almost rotate, a snow white, about 5-9 mm long, 7-13 mm in diameter. *Tepals* subequal, linear-lanceolate, acute, joined at the base for 0.9-1.8 mm, 5.5-9 mm long, 2.5-3.2 mm broad, externally with a purple streak. *Filaments* lanceolate-subulate, thickened, white, the episepal 3.2-4.4 mm long, the epipetal 3.6-5.6 mm long. *Anthers* moderately versatile, after dehiscence 1.2-1.5 mm long; *pollen* orange. *Ovary* elliptical, a pale green, about 2- ? mm long, 1- ? mm wide. *Style* filiform, white, 2.7-4.8 mm long. Stigma capitate. Capsule subglobose, a bright green, about 4-4.5 mm in diam. Seeds ovate-oblong, angled, black, almost crustaceous, 2.3-2.5 mm long.

Habitat.—Fields and sea shores in the central-southern region of Chile, from the province of Nuble to Valdivia.

Nothoscordum nublense [Fig. 12.] differ from the rest of the Chilean species in its intensely white tepals with a purple streak on the outer face.

CHROMOSOME NUMBERS FOR SEVERAL SPECIES OF HYMENOCALLIS

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Salisbury established *Hymenocallis* as a genus in 1812, placing in it American taxa previously assigned to *Pancratium*. The latter genus is entirely an Old World one, its twelve or so species found chiefly in the Mediterranean area. *Hymenocallis* occurs in the warm parts of the New World, and perhaps is otherwise chiefly distinguished from *Pancratium* by its seed. While the seed of Pancratium are black, and angled by "mutual" pressure, those of *Hymenocallis* are usually comparatively large and fleshy, spherical to ovoid, green in color, and only two or a few per cell—although occasionally there are as many as eight seeds per cell.

Over the years there have been several attempts at monographing the genus *Hymenocallis*. In 1837 Herbert placed 14 or 15 species in the genus, although he included a total of 20 varieties under 6 of these different species. In addition, Herbert placed two species, *glauca* and *galvestonensis*, in the closely related genus *Choretis*—species which are now usually considered to be members of *Hymenocallis*. Herbert, also, considered 4 species to belong in another closely related genus, *Ismene*—which many workers now include with *Hymenocallis*. Baker (1888) considered 31 species under *Hymenocallis*, with 7 of these being placed in his subgenus *Ismene*; while three other closely related species were thought to deserve placement in the separate genus *Elisena*. Sealy (1954) considered 27 species to be included without question in *Hymenocallis*, with another 5 imperfectly known species probably belonging here. Traub (1962) listed 56 different species of *Hymenocallis*, with 41 of these being included in subgenus I. *Hymenocallis*, and the other 15 taxa being distributed among the subgenera *Elisena*, *Pseudo-Stenomesson* and *Ismene*.

The taxa of *Hymenocallis* are difficult to study. Material is apt to be difficult to collect, because a number of the taxa only bloom following periods of ample rainfall. As a result one may go into an area where a species has been reported and because of weather conditions, entirely fail to find the taxon. Further, the succulent material of this genus does not dry well, and the result is a paucity of herbarium material, and this of a generally poor quality. Chromosome information is not as valuable an aid here, as in many genera. Information on desired meiotic associations can only be obtained with great difficulty after removing buds from bulbs usually sacrificed in the process. The somatic chromosomes are comparatively large, but also comparatively numerous, and in some taxa the numbers are quite high.

The present author started studying several members of the genus about 1938. Since that time numerous accessions have been studied in the field, in the greenhouse, and in the garden. A total of 206 acces-

sions, 139 from native locations, have been studied. These include 46 from 12 Mexican states, 67 from 12 of the United States, 24 from the West Indies (Puerto Rico, Jamaica, San Saba, New Providence) and two from San Salvador. Somatic chromosome numbers have been determined for 89 accessions. These range from one accession having 38 chromosomes, to one accession having 98, and another 195 somatic chromosomes. More accessions have been encountered with a basic number of n = 23, than any other. Twenty-nine accessions have 46 somatic chromosomes, 3 have had 69, one has had approximately 92, while several with diploid numbers of 47, 48, 50, and 70 have been found—all of these probably being aneuploid numbers derived from 2X = 46 or 2X = 69.

Three very brief reports have been published concerning these cytological findings (Flory, 1950, 1973; Flory and Schmidhauser, 1957). This material is now being organized so that details of the data at hand can be made available to others. The present paper is a first effort in that direction, and the writer is indebted to Dr. H. P. Traub for the stimulus to prepare this material.

In his 1962 paper on *Hymenocallis*, Traub described six new species, and gave amplifications concerning thirteen additional species. A number of these notes were made from plants which the late Mrs. Mary G. Henry had collected at various places, especially in the southeastern United States. Material of several of these taxa was furnished the present author for the cytological studies which he and his students were making on the genus. Dr. Traub has now requested that chromosome information be furnished on several of these accessions. Accordingly, in the present paper numbers and descriptions of the chromosomes in seven different species of *Hymenocallis* are presented. Six of these are from the southeastern United States, and the seventh species is from Mexico.

CHROMOSOME DATA

In Table 1, information is presented on the source of the material studied, and on the somatic chromosome numbers found in the various accessions. The chromosome information is by this author, with the remainder of the table being prepared by Dr. Traub. As indicated in the table, voucher Herbarium specimens for this material have been prepared by Dr. Traub and will be found in the Traub Herbarium (TRA), La Jolla, California.

A brief discussion of the chromosome situations encountered in the several taxa is given below.

Hymenocallis kimballiae, of Traub's Caribaea Alliance, has 70 somatic chromosomes Fig. 13 (1). Of these, 68 have interstitial centromeres—and hence two arms each, while the other two are rod-like telocentrics (with a terminal, or essentially terminal centromere). Quite apparently this is essentially a triploid taxon in which one of the V-shaped chromosomes has split at the centromere, resulting in the two rod-like chromosomes in place of a 69th one with an interstitial centro-

mere.

Material of *Hymenocallis acutifolia* of the Littoralis Alliance, with 46 somatic chromosomes, has been available from two different locations in Mexico. One of these collection points was at Oaxtepec, in the State of Morelos, and the other was near Uruapan, in the State of Michoacan. Both of the accessions of this species have 46 somatic chromosomes, all with interstitial centromeres and two arms.

Table 1. Chromosome numbers of Genus **Hymenocallis** species of Subgenus **Hymenocallis** the Caribaea, Littoralis, Caroliniana, and Henryae Alliances, according to Traub, PLANT LIFE 18: 55-72. 1962. Voucher herbarium specimens deposited in the Traub Herbarium (TRA).

Species	Accession Numbers		Habitat	Chromosomes		
	Flory	Traub		2n	M[1]	T[2]
		CARIBAEA ALLIANCE				
kimballiae Small ex Traub	13309 56	T-261 (*523a & b)	Appalachicola River Estuary, west Fla.	70	68	2
		LITTORALIS ALLIANCE				
acutifolia (Herb.) Sweet	210	T-176 (*245a, b & c)	Oaxtepec, Mexico	46	46	—
	235	T-264 (*246)	Uruapan, Mexico	46	46	—
		CAROLINIANA ALLIANCE				
caroliniana (L.) Herb.	240	T-219 (*254a & b)	Covington Co., Ala.	52	(40	12?)
	225	T-213 (*244a & b)	Mammoth Cave, Ky.	54	38	16
	209	T-127 (*243a & b)	Conecuh Co., Ala.	54	38	16
rotata (Ker-Gawl) Herb.	227	T-220 (*250a & b)	Marion Co., S.C.	40	40	—
	234	T-260 (*281)	Altamaha R., near Baxley, Ga.	40	40	—
palusvirensis Traub	185	T-151 (*251a, b & c)	Brunswick Co., N.C.	40	40	—
		HENRYAE ALLIANCE				
henryae Traub	204	T-130	Santa Rosa, Fla.	38	34	4
palmeri S. Wats.	214	T-230 (*244a & b)	Palm Beach, Fla.	48	44	4

*—refers to numbers of herbarium specimens
M[1]—metacentric chromosomes
T[2]—telocentric chromosomes

There are three different species listed in Table 1 belonging to Traub's Caroliniana Alliance. Two of these species, *H. rotata* and *H. palusvirensis*, each have 40 somatic chromosomes. The third species, *H. caroliniana*, has a 2n of 52 where collected at Opp in Covington County, Alabama, and a somatic number of 54 where collected at Evergreen in Conecuh County, Alabama, as well as from near Mammoth Cave, Kentucky.

The 54 somatic chromosomes of *Hymenocallis caroliniana* from Mammoth Cave, Kentucky, are drawn in Fig. 13 (2). A study of this figure will show that there are 38 two-armed chromosomes present, along with 16 elements with terminal centromeres, and which are sometimes

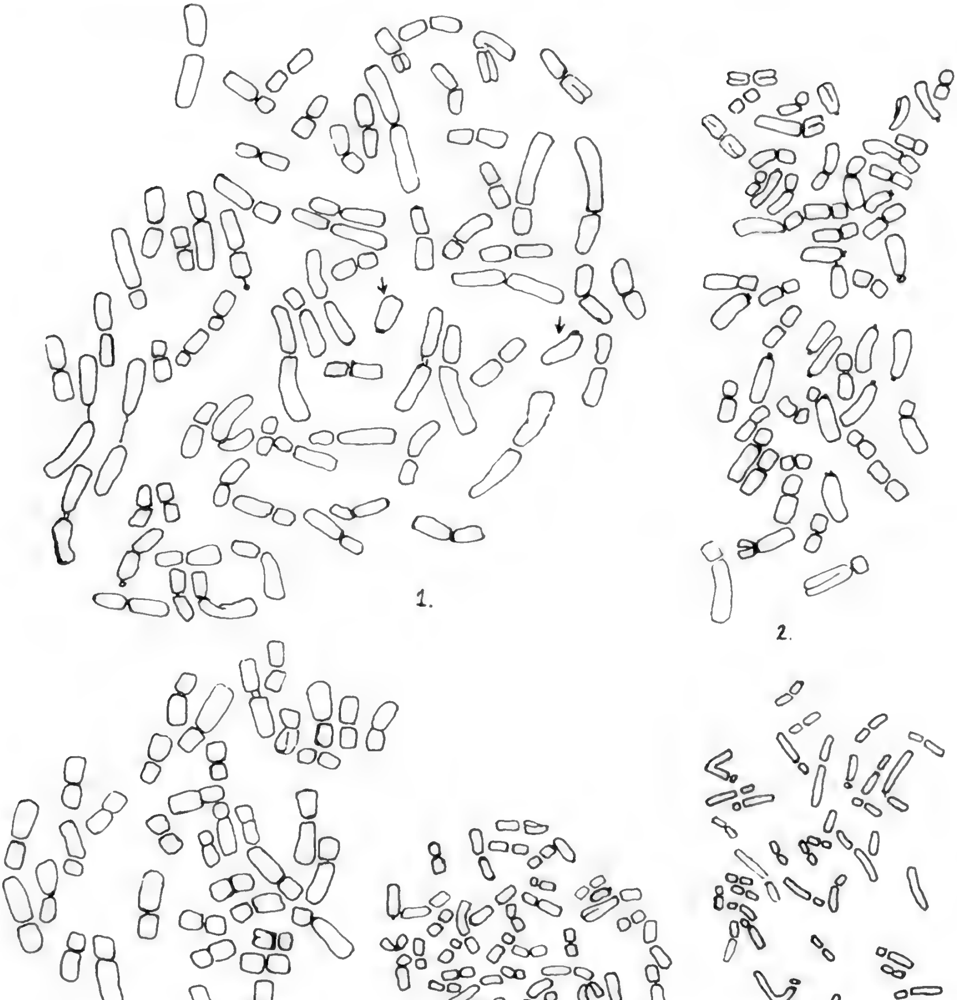

Figure 13. Chromosomes of five **Hymenocallis** species of S. E., U. S.—(1) **H. kimballiae** Traub (T-261; 13309-56). 2n=70. There are 68 chromosomes with centromeres located in median, submedian, and a few in subterminal positions. Two chromosomes (at arrows) are telocentric. X1950. (2) **H. caroliniana** (Linn.) Herb. (T-213; 225). 2n=54, with 38 two-armed chromosomes and 16 telocentric ones. X1950. (3) **H. palusvirensis** Traub (T-151; 185). 2n=40. No telocentric chromosomes. X1950. (4) **H. palmeri** S. Wats. (T-230; 214). 2n=48, with four chromosomes being telocentric. X1450. (5) **H. henryae** Traub (T-130; 214). 2n=38, with four chromosomes being telocentric. X1450.

called "T" chromosomes. Essentially this same situation with reference to "T" chromosomes can be seen to occur in the 54 chromosomes of the taxon from Conecuh County, Alabama. Likewise, the plants in the collection from Covington County, Alabama, have approximately 40 two-armed chromosomes, along with 12 telocentric ones—to make up its total of fifty-two.

Studies of the two collections of *H. rotata* show that both have 40 somatic chromosomes, all of which are two-armed. No telocentric chromosomes occur among the 40. This same situation occurs in *H. paluscirensis*, where again the chromosome number is 2n = 40 Fig. 13 (3), with all of these being two-armed, and none telocentric.

Two representatives of the Henryae Alliance are reported upon in this study. *Hymenocallis henryae*, collected at Santa Rosa, Walton County, Florida, has 38 somatic chromosomes Fig. 3 (5)—next to the lowest number known for any taxon in the genus. Of these, four have terminal centromeres, with 34 having interstitial centromeres. *Hymenocallis palmeri*, of the same Alliance, was collected at Palm Beach, in Palm Beach County, Florida. This representative had 48 somatic chromosomes Fig. 13 (4), of which four have terminal centromeres, and the other 44 are two-armed, with interstitial centromeres.

In 1956 the present author collected specimens of *H. palmeri* about 80 miles southwest of the collection point of the T-230 taxon referred to in the preceding paragraph. The 1956 collection was made in Dade County, 12 miles north of Park Motel, Homestead, Florida, on the east side of Florida State Highway 27, 8.7 miles south of the intersection of U.S. 41 and Florida 27. The bulbs collected here were growing in black sandy soil in pockets of oolite honeycombed rock. The *H. palmeri* plants collected in 1956 had 46 somatic chromosomes, none with terminal centromeres. In 1972, the 1956 collection point was revisited, but the area was now covered with housing developments. However, in 1972 additional bulbs of *H. palmeri* were secured several miles west of Homestead, Florida, along the edge of the Everglades National Park. These plants are presently in greenhouse culture, and will be studied cytologically when time permits.

LEGEND FOR FIGURES

The five drawings, in Fig. 13, are all camera lucida drawings of the outlines of chromosomes in complements at metaphase division in acetic-orcein root tip squash preparations from *Hymenocallis* species. All drawings made at table level, using 90X oil immersion objective, and either 15X or 10X oculars. Root tips were pretreated with .2% colchicine for from 2 to 5 hours.

DISCUSSION

Flory and Schmidhauser (1957) have earlier reported that the most frequent somatic chromosome number found in *Hymenocallis* is 46, and that accessions in which 2n = 40 are next in frequency. Telocentric chromosomes are found in the complements of many taxa in the

genus, but have never been found where the 2n numbers are 40, 46, or 69 (triploids based on n = 23). It was also reported that most numbers other than 46 (or 69) or 40 reduce to one of these, if half the number of telocentrics is added to the number of chromosomes with interstitial centromeres. This is seen to be the case with the chromosome numbers for the accessions reported upon here.

The present report presents chromosome information for 11 accessions, involving 7 species. The chromosome numbers determined for the several taxa (Table 1) have been 38 (1 taxon), 40 (3 taxa), 46 (2), 48 (1), 52 (1), 54 (2), and 70 (1). The number of two-armed and telocentric chromosomes for these same taxa are: 34 + 4 (2n = 38); 40 + 0 (2n = 40); 46 + 0 (2n = 46); 44 + 4 (2n = 48); 40 + 12 (2n = 52); 38 + 16 (2n = 54); and, 68 + 2 (2n = 70), respectively. It will be noted that 46 chromosomes with interstitial centromeres, and two arms each, have a total of 92 arms. Also where 2n = 48 with four telocentrics, there is a total of 92 chromosome arms in each complement. The same is true where 2n = 52 with 12 telocentrics, and where 2n = 54 with 16 telocentrics—there is a total of 92 arms in each complement. Hence, in each of these cases—whether the 2n number is 46, 48, 52, or 54—the total number of arms involved in each complement is 92. Likewise, where 2n = 70—in *H. kimballiae*—with two telacentrics being present, there is a total of 138 arms present. This is the same number of arms which occurs, of course, in triploids having 69 somatic chromosomes, all with interstitial centromeres and, hence, two arms. The exact explanation for the chromosome situation in *H. henryae* is still to be deciphered.

It was long thought (tracing from Nawashin, 1916) that all centromeres were interstitial, and that when telocentic chromosomes arose through misdivision they were either converted into isochromosomes or were lost.

The studies of Marks (1957) put a different light on the problem, and showed that at least some kinds of telocentric chromosomes have centromeres similar to those of metacentric chromosomes. Marks presents a good case for his statement that "There is no evidence that a telocentric chromosome is unstable because its centromere is terminal."

In the case of *Hymenocallis* the occurrence of varying chromosome numbers, often due to variations in the number of V-shaped and rod-shaped chromosomes present, appears to have played a significant role in speciation, at least in connection with certain taxa. This is not the place to discuss the relative merits of arguments for centric fusion versus centric fission (re the so-called 'Robertson's law,' based upon Robertson, 1916). In *Hymenocallis* it is evident, however, that either the decrease in chromosome numbers due to centric fusion, or the increase due to centric fission, has occurred and has played an important role in the phylogeny of the group.

SUMMARY

Table 1 lists chromosome numbers for 11 accessions of *Hymenocallis*

involving 7 different species. These numbers range from 38, through 40, 46, 48, 52, and 54 to 70. Where numbers of 40 and 46 occur, all chromosomes have interstitial centromeres. Telocentric chromosomes occur in the complements having other somatic numbers. It is pointed out that if half the number of telocentrics are added to the number of metacentric chromosomes, for any given complement, that the sums will be 46 or 69 (or in certain other cases, 40) in each case, except for *H. henryae* where the number would be 36. Two different chromosome numbers are reported here for *H. caroliniana*, 2n = 52, and also 2n = 54; this is due to differing numbers of telocentrics in the different accessions, and the total number of somatic chromosome arms equals 92 in each case.

ACKNOWLEDGEMENTS

Several students and colleagues have aided and collaborated, at different periods, in the study of *Hymenocallis,* particularly of its chromosomes. Especially to be mentioned here is the work of Dr. Thelma Ficker Schmidhauser who, as a graduate student at the University of Virginia during the 1950's, examined a rather large number of accessions, both cytologically and morphologically. Figures 4 and 5 are reproduced from her drawings. Dr. Ray Flagg aided the study while a postdoctoral Associate at the Blandy Experimental Farm at the University of Virginia. Additional valuable assistance has been rendered by Mrs. Rina Varma and Dr. Ruth Phillips. Dr. Hamilton P. Traub not only provided the material studied in the present work, but has supplied considerable additional material and has encouraged the study in various ways.

At different times the *Hymenocallis* study has had the support of Grants B3296, G11080 and GB1767 from the National Science Foundation, as well as grants from the Research and Publication Fund of Wake Forest University.

Sincere appreciation is expressed to all these persons and institutions.

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AMARYLLID NOTES 1975

HAMILTON P. TRAUB

Quitoensis Alliance, Subgenus *Hymenocallis*, Genus *Hymenocallis*, Salisb. (Amaryllidaceae), *Alliance nov.*, ovulis per locula 18—20, flore per umbella uno, staminibus incurvatis, et chromosomatibus diploideis 2n = 24. Typus: *Hymenocallis quitoensis* Herb.

Crinum asiaticum f. *cuperfolium* f. nov. Forma a forma typica speciei foliis aeneo-cupreo-rubris et floribus purpureo-coloratis recedit. Holonomenifer: Traub Nos. 621a and 621b (TRA), July 12, 1958; cult. Calif.; originally obtained from Hawaii, and apparently native to southeast Asia.

PLANT LIFE LIBRARY—continued from page 26.

EAST AFRICAN VEGETATION, by E. M. Lind, M. E. S. Morrison and A. C. Hamilton. Longmans, Inc., 72 5th Av., New York City 10011. 1974. Pp. xvii + 257. Illus. $17.50.—In this generously illustrated book, the major types of vegetation of Uganda, Kenya and Tanzania are described from the ecological view point. The regions are considered under the headings of forests; rangelands; inland aquatic vegetation; the vegetation of the sea coast, and high mountain vegetation. The factors affecting vegetation, climate and soils are discussed; and a brief history of the overall vegetation region is presented. A bibliography and plant name index complete the volume. Highly recommended.

TREE FLORA OF MALAYA, VOL II, edited by T. C. Whitmore. Longmans, Inc., 72 5th Av., New York City 10011. 1972. Pp. (vii) + 444. Illus. $40.00.—Subtitled, **A Manual for Foresters**. Vol. I was previously published in 1972, comprising 28 families. Vol. II. covers a further 30 families which takes the work to over half way. The keys are based on leaves and twigs as far as possible since they are usually available for identification. Recommended to foresters, professional botanists and others interested in tree flora.

THE INDIGENOUS TREES OF THE HAWAIIAN ISLANDS, 2nd edition, by Joseph F. Rock, and addenda by Derral Herbst. Chas. E. Tuttle Co., Rutland, Vermont. 1974. Pp. xx + 548. Illus. $22.50.—The 1913 edition had long been out of print, and due to popular demand, this excellent beautifully illustrated 2nd edition has appeared. Following the informative Introduction by Dr. Carlquist, and the preface by the author, the key to the 43 families to which the trees were referred, is provided. Then follow the descriptions of the forest regions, and the scientific descriptions of the families, genera and species of the Hawaiian tree flora. Addenda by Derral Herbst bring the scientific nomenclature up-to-date. An index of the scientific names completes the volume. The illustrations are so outstandingly beuatiful that they merit special mention. The book is very highly recommended to all interested in tree flora.

SOIL ORGANIC MATTER AND ITS ROLE IN CROP PRODUCTION, by F. E. Allison. Elsevier Scientific Publ. Co., 52 Vanderbilt Av., New York City 10017. 1973. Pp. v + 637. Illus. $52.00.—The final and important contribution by an eminent soil scientist will be welcomed. The author emphasizes the major role of organic matter in determining the microbiological, chemical and physical aspects of soil fertility. The subject is developed under the following headings -the soil and living matter in it; formation and nature of organic matter of mineral soils; sources and possible fate of nitrogen in mineral soils; function and possible effects of organic matter in mineral soils; some organic matter and crop management problems in mineral soils; and organic soils. Very highly recommended to students of soil science and all engaged in crop production.

AQUATIC PLANTS OF AUSTRALIA, by Helen I. Aston. International Scholarly Book Services, Box 4347, Portland, Oregon 97208. 1973. Pp. xii + 368. Illus. $34.65.—Based on original research by the author, this is the first comprehensive guide to the aquatic plants of Australia. It is illustrated with more than 130 excellent pen-and-ink drawings. The main text includes more than 200 species with full descriptions and details of habitat and geography, and synonyms. Appendices on the water Hyacinth pest, distribution chart, six maps showing locations, rainfall and altitude. Bibliography and plant name index complete the volume. This is an indispensable guide for the professional botanist, student, water trusts, irrigation authorities, conservationists and farmers. Highly recommended.

FLORA OF THE U.S.S.R., VOL XVII. UMBELLIFERAE (continued), translated from the Russian; compiled by E. P. Korovin, et al. International Scholarly Book Services, Box 4347, Portland, Oregon 97208. 1974. Pp. xviii + 285 + Map. Illus. $28.00.—In this volume the text of the **Umbelliferae** is completed, and is followed by that of the **Cornaceae.** Following the systematic index to the species in Vol. XVII, and the brief Preface indicating that Vol. XVII deals with the remainder of the **Umbelliferae** and the **Cornaceae,** the genera and species of these groups are described in detail. Indices to the genera and species of the **Umbelliferae** and **Cornaceae,** and families of the Archichlamydeae, list of the Vegetation Regions of the USSR, abbreviations for Russian institutional publications and a Map of the USSR, complete the book.

BOTANY IN THE LABORATORY, by Maynard F. Moseley and William K. Purves. John Wiley & Sons (Hamilton Publ. Co. Div.) 605 3rd Av., New York City 10016. 1974. Pp. x + 196. Illus.—There are sections on the use of the microscope, cell structure and physiology of the plant; the divisions of the plant kingdom—**procaryotes,** bacteria, etc., and **eucaryotes,** fungi, algae, bryophytes and vascular plants. A section on pollutants in the environment, and an index complete the volume.

PLANT LIFE LIBRARY—continued on page 72.

3. GENETICS AND BREEDING

BREEDING AND CULTURE OF AMARYLLIS

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In Plant Life for 1972 and 1973, the writer proposed the liberal use of inbreeding and eventual outcrossing in a rational program of *Amaryllis* improvement. Experiments in such a program, covering a span of about 35 years, have been very rewarding, especially in consideration of the modest facilities available for the work. The results are consistent with the experience of those breeders who have developed F:1 hybrids of many vegetables and flowers.

Some of the opinions and findings expressed below are controversial, and it is to be understood that they are given with modesty and open-mindedness.

It appears that continued inbreeding and selection steadily give greater uniformity of those genetic characters selected, provided that

1. Sterility problems can be overcome.
2. Sufficient numbers of seedlings of a given inbred are grown to permit a significant selection. Some inbred crosses or selfs may have to be repeated long enough to find one or more improved seedlings, especially during the early generations, for inbreeding brings out many freaks and weaknesses in genera that have long been crossed randomly.
3. The traits selected for improvement by inbreeding do not depend upon the combination of *dissimilar* genes, i.e., heterozygosity. Inbreeding can only make a strain more *homozygous*. If successive inbreeding continues to give seedlings of widely varied types, you will know you are on the wrong approach.

After an *Amaryllis* species has been crossed into an inbred strain, only two or three generations of additional inbreeding seem to be required to eliminate all those species traits that are *not* desired, perhaps because species are already so uniform genetically. For instance, the dotted color pattern of *Amaryllis lapacensis* Cardenas has been easily transferred into two inbred strains of large whites.

Sterility in inbreds has been discussed in the writer's previous papers. Gibberellins and other chemicals are helpful, and usually one can successfully eliminate sterility by resorting to either sibling crosses or back crosses on good ancestors, rather than continued selfing. This compromise does not reduce the degree of inbreeding very much, especially if a selfed generation is introduced as often as feasible.

Another conclusion drawn from the writer's projects is that crosses between two inbred strains tend to exhibit remarkable hybrid vigor, or heterosis, unless a damaging chromsomal incompatibility exists between those particular strains. Parents with seven-inch blossoms regu-

Fig. 14. Dr. Cage Amaryllis—**Left**, pure white outbred, 9-inch diameter flower; **Right**, a red-and-white tricolor reproduced from seeds, 8-inch diameter flower.

larly produce offspring with nine-inch blossoms, for instance—all solid dark red, front and back of segs, and all with flat leopoldii form.

Of course, inbreeding cannot stabilize or improve qualities of a plant line that do not exist genetically in the breeding stock. Barring mutations, endless inbreeding will not produce red blossoms if none of the genes of the inbreeding stock tend to produce red pigmentation. That is to say, a major (probably *the* major) aspect of the art of inbreeding and outcrossing to obtain *quality* in the uniform seedlings is the selection of breeding stock initially. Undesired plants are not rewarding, no matter how uniform.

If one lacks good stock that is not known to be inbred to some extent already, then a good starting point is a few beautiful specimens that have many of the qualities desired. Self the individuals or cross siblings and try to identify those lines having qualities that become more uniform each new generation. Stated another way, if one does not desire the qualities that tend to become more uniform in an inbred line, start anew with new parents.

Sometimes, it may appear to the breeder that an inbred line could be improved by breeding in one or more of the traits of a species, another inbred, or a mixed hybrid. Some of the worst problems arise at this point. The inbred line may be either diploids or tetraploids, and the chosen plant to be introduced may be diploid, tetraploid, triploid, or aneuploid. An even more subtle incompatibility may exist to produce distorted offspring or sterility. Very often the planned cross is between a tetraploid and a diploid (for example, when a breeder attempts to introduce the yellow color of a small diploid species into a large white tetraploid line) and troubles abound. If seedlings are produced, they are probably triploids. They may be quite sterile. If not, what does one do next? The genes for yellow color have already been seriously diluted by the tetraploid genes, and anyway, triploids seldom can be selfed. If the diploid species is crossed back upon the triploid, and if fertile seeds are luckily produced, they would appear to be diploids, and in the writer's experience, the desired traits of the large white tetraploid are almost totally lost. On the other hand, if the original tetraploid white, or another one, can pollinate the triploid, perhaps same tetraploids are produced, but now the yellow genes are diluted enormously, and it is very difficult to select out the plants that have *any* yellow genes for further inbreeding. The requirement now: thousands of seedlings, large facilities, and a lifetime of work.

Dr. Bell (Plant Life, 1973, p. 59) has discussed the above problem and others in an excellent paper. Triploids apparently *can* play an important part in the synthesis of desired genetic characters into a single strain, but the work is difficult. As stated earlier, the writer has almost surely transferred the dots of a diploid species into two fertile tetraploid lines by way of triploid hybrids.

However, to eliminate the triploid phase, it is proposed that the doubling of chromosomes of some of the diploid species and inbred

Fig. 15. Dr. Cage Amaryllis—Left, large red, 10-inch diameter flower; inbred, fairly uniform from seeds. Compared (at the left in same photo) to a good Amaryllis gracilis red clone. Right. A large flushed hybrid, a striking and novel strain.

lines would be an enormously important contribution to the breeding of excellent new types of hybrids. These new tetraploids would presumably cross easily with established tetraploid hybrids without dilution and sterility problems. A tetraploid *A. evansiae* should be extremely valuable.

Apparently, many of the Dutch and South African named clones have resulted from considerable inbreeding, whether the breeders were conscious of the fact or not. For instance, the seedlings of Ludwig's "It" show much variation in growing traits, but the wine color is consistent enough to indicate inbreeding. Similarly, "Nostalgia" gives uniform seedlings with hybrid vigor when crossed upon some of the writer's inbred red strains. Therefore, it is felt that one approach to the growing of superior commercial seedlings is to cross selected Dutch clones with severely inbred lines that show dominance in vigor, color, and ease of growing.

Whether one has the time, wish, and discipline to develop uniform inbred strains or not, it is recommended that one should breed *Amaryllis* with an objective as clear as one can devise. And severe, ruthless discarding (in the shredder, not to friends) is advocated for all except those seedlings that advance toward one's objective. Further, it is felt that too many simultaneous projects are fatal to the success of the amateur.

While a general discussion of the culture of *Amaryllis* is too broad a subject to add to this paper, some cultural procedures that have been especially useful in the writer's breeding work might be worth describing.

Seeds from carefully recorded crosses are planted as quickly as convenient after they are dry enough to be easily removed from the capsules. If planting is to be delayed for a few weeks or even a few months, seeds are stored in clean paper envelopes in a cool, dry place. The seeds are usually planted in small flats that are from one to three inches deep, in an equal mixture of milled sphagnum moss and vermiculite. Finely shredded peat moss with an equal amount of vermiculite or sand or perlite is also effective. The dry mixture is poured almost to the top of the flats, unless they are deep, and then it is leveled and wet thoroughly with a watering can. Seeds are laid flat, as close together as possible, with only enough space between rows to identify the different crosses with short labels. After seeds are barely covered with milled sphagnum or clean sand or both, the flats are gently watered again and placed in plastic bags, which are closed by twisting the open end.

If clean materials have been used, the enclosed flats can be placed in a warm, shady place (65° to 80°F) and ignored until the cotyledons appear. Then the plastic bag is removed, the flat is given a very light sprinkling of 1% Disyston granules (Systemic Pesticide Granules) and watered gently. If the systemic granules are not available, one teaspoon per gallon of water of a fruit-tree spray powder containing

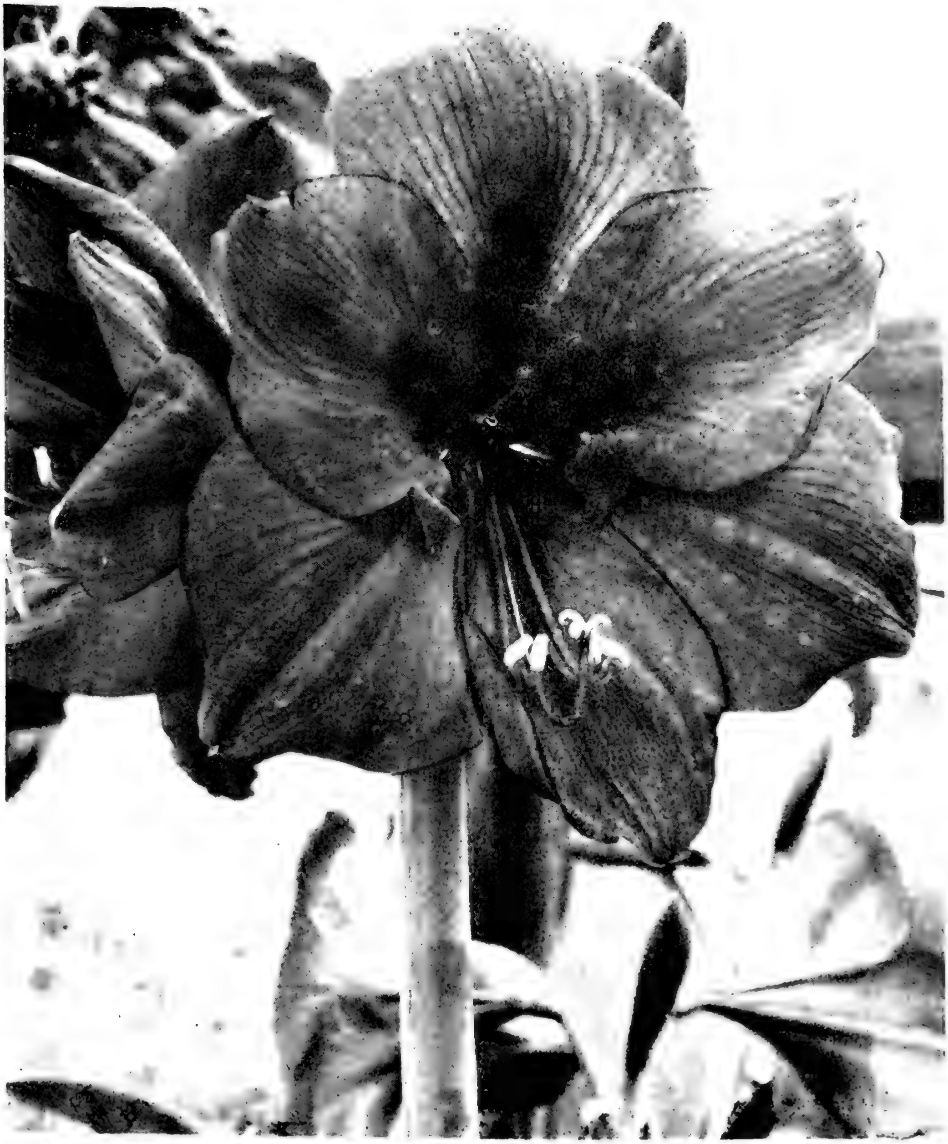

Fig. 16. Dr. Cage **Amaryllis**—9-inch diameter flower; inbred red to reproduce seeds for vigorous pure reds. Photo Palo Alto (Calif.) Times.

methoxychlor, Captan, and malathion is used in this first watering. An insecticide is usually not really required at this stage, but the use of one is good insurance. A week solution of complete fertilizer is used in later irrigation (for instance, one-half teaspoon per gallon of Rapid-Gro about one time per week).

The seedlings are grown in the seed flats until they are crowded but not long enough to get matted roots. They can then be easily separated and the strong ones are planted either in six-inch-deep boxes on four-inch centers or four or five in a five-inch pot. In the deep boxes the bulbs are grown until they bloom; in the pots, the bulbs are shifted once, without separating them, to an 8-inch pot, or a 2-gallon rose liner can, depending on the size of the strain. A growing mixture of

50% Mica Peat or Jiffy Mix
25% fine perlite or agricultural pumic or sand
25% leaf mold

but many good potting mixes are available. Soluble fertilizers are probably best for the amateur, 25% of recommended strength and used twice as frequently as recommended on the label. A formula high in potassium and rather low in nitrogen seems best, but the formula does not seem to be critical.

The growing media of all bulbs are drenched every three months with a fungicide, usually alternating between Benlate (1 tsp/gal) and Truban (5 tsp/gal). A new fungicide with long residual systemic action is Banrot (Mallinkrodt, 1 tsp/gal), and this has produced excellent results in its first trial when used exclusively. Captan and Terrachlor are also valuable in most situations. Rots of roots, bulb, leaves, and scape have apparently been eliminated by the drenches, but use of the fungicides simultaneously with other chemicals *can* be disastrous.

Most strains bloom from seeds in from 14 to 18 months in a glasshouse with night temperatures of about 60° most of the year.

It is probably a painful decision for anyone to destroy all plants exhibiting the symptoms of mosaic virus, especially when most symptoms can be made to disappear temporarily by treating the soil with iron, magnesium, and a weak acid solution to maintain a pH of about 5.8, but the decision can eradicate the disease. This decision is regretfully recommended as being worth the effort. After this sad note, let the paper close with the opinion that the writer has apparently *cured* virus disease in three bulbs by gradually increasing the concentration of iron chelate in the soil over a period of several weeks until the roots showed injury. Then the bulbs were dried and kept completely dormant, without roots or leaves, for more than a year. Either morning dew or a light mist of water moistened the bulbs nearly every day to keep them from dying, but they were dry during most of each day, resting on a board. Temperatures varied from 50° to 95°F. during the year. One hopes the experiment will be tried by others. Virus can apparently be kept from spreading by treating the soil around the infected plants continually with a systemic insecticide and avoiding the handling of any part of the plant.

Although this long breeding project, following one of the modern professional techniques, has brought much personal joy, it is fervently hoped that commercial growers or experienced amateurs will take up the work while the complete breeding records and plant material (and the breeder) are still intact.

THE MOST BEAUTIFUL FLOWER IN THE WORLD

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My hobby has been hybridizing Amaryllis since about 1953, when I purchased my first bulbs, potted them and watched them grow and bloom. My first cross involved the Warmenhoven clone 'Sweet Seventeen' and a Howard & Smith bulb. I then crossed a seedling from that cross with 'Ludwig's Scarlet'. I have added no new bulbs to my breeding program since then, using only my best seedlings. I have been breeding toward round, flat faces with no green in the throat. I succeeded in eliminating the green throat rather early, and then just this year a seedling bloomed for the first time with what I would call perfect form. When viewed from the side, it is absolutely perfectly flat, and the segs are broad and the face is round. I am not very good at describing colors, but I would call it a light red color. I crossed it this spring with another seedling that bloomed for the first time. It is a very beautiful dark red, deepening to a still darker throat, with broad segs and a round face. It is my favorite. As you can see, the form of the flower is very important to me.

I still believe what I said when I saw my first Amaryllis in flower, which was, "Its the most beautiful flower in the world."

PLANT LIFE LIBRARY—continued from page 64.

THE EDIBLE ORNAMENTAL GARDEN, by John E. Bryan & Coralie Castle. 101 Productions, 834 Mission St., San Francisco, Calif. 94103. 1974. Pp. 192. Illus. $7.95., Paper. $3.95.—The authors have combined the vegetable and ornamental gardens in the interests of food and beauty. Following sections on general plant culture, and cooking with flowers, leaves and herbs, the main body of the book is devoted to selected plants from **Artichoke** to **Violet and Garden Pansy.** It is remarkable that the Daylily, **Hemerocallis,** is omitted, which is a classical example of plant in this class cultivated in China. Recommended to interested amatuer gardeners.

TOMATOES—THE MULTI-PLANT METHOD, by Leopold Klein. William-Frederick Press, 55 E. 86th St., New York City 10028. 1974. Pp. 90. Illus. Paper, $3.95.—Following a brief autobiography of the author and foreword, the author describes his new method of growing tomatoes in detail ,including 100 step-by-step photographs, showing how the planting of four plants in a large plant box or similar rectangular ground unit (with four plants each) simplifies culture for one watering and feeding that satisfies four plants at one time. It is a method that many interested persons will want to take up to grow their own tomatoes. Very highly recommended.

PLANT LIFE LIBRARY—continued on page 101

4. AMARYLLIS CULTURE

[ECOLOGY, REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

FLOWERING OF DRY, DORMANT AMARYLLIS BULBS

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Usually an article of this kind would have the word *forcing* in its title. I do not object, but have chosen a different approach, for I think the concept of "forcing" *Amaryllis* bulbs can be misleading. That is to say, tulip or daffodil bulbs are naturally dry and rootless during their dormant season, and one can either let them develop roots in the ground in winter and bloom in their normal spring season, or one can "force" them to bloom somewhat earlier.

A few *Amaryllis* species and hybrids behave in a similar manner, but not many. Even in deep dormancy, most *Amaryllis* bulbs retain their roots under optimum growing conditions and some even retain leaves. They can be transplanted with very little harm during dormancy, into a potting mix similar to those described by Doran (Plant Life, 1974) if the roots suffer little damage. However, if bulbs have been stored out of soil, roughly handled, dried, or perhaps shipped long distances, they usually retain very few roots—and much fewer leaves.

Therefore, while one may indeed wish to "force" dry bulbs into bloom at a particular time, I think the main problem is to achieve excellent bloom at *any* time from virtually rootless bulbs. I have increased my study of this problem during the past year.

One approach was to purchase samples of all obtainable "pre-planted" or "pre-potted" hybrid *Amaryllis* bulbs from dealers. Those potted bulbs are sometimes attractively packaged and in general bloom better than those offered a few years ago, but they still leave much to be desired in quality of bloom. Those that bloomed and rooted most normally were planted in pure vermiculite, but the bulbs were from a mediocre strain, and they usually toppled over in the loose mix. Bulbs planted in a mixture of sphagmun peat and vermiculite or perlite were nicely packaged and of fair quality, but some rotted, some bloomed briefly on short scapes, and none performed like an established bulb of good quality. Watering seemed to be critical. The best and worst performances came from bulbs potted in straight sphagnum peat, perhaps with chemical additives. Some rotted, but some bloomed fairly well, even though the peat moss was rather soggy.

In preparation for the study, I had stored some mature bulbs in dry sawdust in the fall of 1973. As many roots as possible were retained, and bulbs were soaked for 30 minutes in a suspension of 6 tbs. of 25% Captan per gallon of water (or for 10 minutes in 1½ tbs. of

Lysol Disinfectant per gallon of water) and dried in shade before storage. After from three to five months of dormancy, I cut all remaining roots from half of the bulbs. The following treatments, based upon ideas developed over many years, were studied.

1. Some of the dry bulbs were soaked for one hour at 70° F. in a solution of Benlate, the bases dipped in a rooting powder, allowed to dry in open air, and planted in a mix of equal parts of sphagnum peat moss, vermiculite and fine perlite. The potted bulbs were stored for one week to two months and then were kept moist at 70° F. All bulbs bloomed better than controls that had no Benlate soak, and all bulbs bloomed better than the commercial bulbs described above. The blooms were larger and lasted longer. No bulbs rotted. Liquid fertilization was started while bulbs were in full bloom, and those that were kept are still growing well. Again, refer to Doran's paper in Plant Life, 1974, for optimum feeding. Healthy new roots were found on all bulbs examined.

2. Other fungicides having some systemic action were tried on a small scale in the manner described above under item 1. These were Mertect 160 (60% Thiobendazole, Merck, 1 tbs./gal. water) and Banrot (Mallinskrodt, 1.5 tsp./gal. water). These produced good blooms compared with the control bulbs, but more tests are needed for significance. A few bulbs soaked in Banrot suspension at *beginning* of dormancy, started well after 120 days of dormant rootless storage, without further treatment.

3. I have developed a paint-like material in which clean bulbs may be dipped or brushed prior to storage. A rather heavy film of the paint adheres well to the bulb and seems to protect it during storage and "forcing" from fungi, insects, and excessive loss of moisture. Bulbs were stored in open, ventilated bins, at about 50° F. and planted without removing the coating. The paint also contains a rooting hormone. Application for a patent has been made, and future reports will be written. Arrangements can be made by commercial growers and shippers for trials of the material.

ELIMINATION OF MOSAIC VIRUS FROM **AMARYLLIS** L. PART II. VIRUS ASSAY

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INTRODUCTION

Plants of *Amaryllis* L. recovered from virus diseased bulbs *via* shoot-apex culture were assayed for the presence of *Amaryllis* mosaic virus. Both infectivity tests and electron microscopic methods pro-

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vided no evidence of Amaryllis [syn.- -Hippeastrum] mosaic virus being present in symptomless plants grown for 12 month in the greenhouse.

This paper gives the ultimate results of the experiment described in Plant Life 1974, where the production and culture of shoot apices *in vitro* were reported.

MATERIALS AND METHODS

Plants of *Amaryllis* obtained *via* shoot-apex culture and grown in the greenhouse for 12 months were assayed for the presence of *Amaryllis* mosaic virus using direct negative staining (5**) and infectivity tests.

Infectivity tests were done by triturating with a mortar and pestle leaves of amaryllis with 0.025 M phosphate buffer pH 7.2, and 600 mesh carborundum, and inoculating with the fingertip *Gomphrena globosa* and *Chenopodium quinoa*, proved earlier to be local lesion hosts for *Amaryllis* mosaic virus.

The inoculated plants were examined daily for a period of one month for possible signs of virus transmission. The infectivity tests were carried out twice within a period of two months. Leaves of symptomless and diseased amaryllis plants were used as control and comparison in all conducted tests.

RESULTS AND DISCUSSION

The amaryllis plants obtained *via* shoot-apex culture were investigated under an electron microscope. The quick dip method of negative staining failed to provide evidence of *Amaryllis* mosaic virus particles being present in the symptomless plants grown for 12 months in the greenhouse.

Infectivity tests likewise proved the amaryllis plants to be free from the virus, since the inoculation of their cell sap did not produce the local lesions characteristic of the symptoms caused by preparations from HMV infected amaryllis plants; therefore, these plants derived from shoot-apex culture were concluded to be freed from *Amaryllis* mosaic virus.

The plants are under periodical observations for macroscopic symptoms of mosaic disease, and after 22 months of greenhouse culture plants remain free from the mosaic disease.

SUMMARY AND CONCLUSIONS

A number of bulbs of Hybrid *Amaryllis* clone 'Wedding Bells' showing mosaic symptoms in their leaves were investigated for the presence of a causal agent of the mosaic and found to contain Hippeastrum mosaic virus.

Shoot apex culture was investigated as a means of recovering virus-free subclones. Bulb cuttings maintained in a water-saturated atmosphere were used to provide large numbers of clonal shoot-apices. A modified Murashige and Skoog (15) liquid nutrient medium, as defined

** Literature review in Plant Life 1974 pp. 112-113.

for asparagus shoot-apex culture permitted satisfactory growth of amaryllis shoot-apices cultured on filter-paper bridges in 25 x 150 mm 'Pyrex' tubes. Plants were large enough to be grown in normal greenhouse culture after approximately 8 weeks of culturing in tubes.

The assay of plants surviving a period of one year of greenhouse culture showed a large percentage of subclones to be free from Hippeastrum mosaic virus.

A significant quantity of virus-free amaryllis plants can be produced by a combination of bulb cuttage to provide a quantity of shoot-apices, and excision of these at an early stage with subsequent culturing on an artificial medium until large enough to grow conventionally. This should provide the means of recovering Hippeastrum mosaic virus-free stock plants for further vegetative propagation. Subsequently, control measures such as rogueing of secondary infected plants, weed and insect control, and maintaining the plants under insect-proof screens, should enable the stock plants to remain free from *Amaryllis* mosaic virus.

HABRANTHUS TUBISPATHUS (L'HERIT.) TRAUB

Hamilton P. Traub

Habranthus tubispathus (L'Herit.) Traub, formerly known as *Habranthus andersonii* Herbert, is a variable species in minor characters of value only in distinguishing forms within the species in flower size, color, plant size, etc.

Herbert (Amaryll. 1837, p. 168) listed six varieties. (1) *aurea*, golden; (2) *cuprea*, coppery; (3) *obscura*, dark, especially in bud; (4) *brevilimba*, short-flowered, with broader leaves; (5) *parvula*, small flowered (Herb. Amaryll. 1837, Pl. 26, fig. 4. 1837), and (6) *texana*, tepals roundish, obtuse. Others have named other varieties.

Under present day taxonomic practice, such minor differences are usually not considered important enough to require naming because the category, *variety*, is no longer used. It is either a sufficiently great variation that can be included under the category, *subspecies*, or a lesser variation which can be accommodated under the category, *forma*, that are recognized. However, this latter category is usually used to distinguish *lesser variations that are important horticulturally*. Thus most minor variations should be included under the species, and forma descriptions should be used sparingly.

One of these is the rose-colored form, which the writer distributed widely, as a variety, is quite distinct in color from the usual forms.

Habranthus tubispathus forma *roseus* Traub, *forma nov.* Flos roseus. Holomenifer in Traub Herbarium.

Another form, proposed by Ravenna as a variety appears to be worthy of naming.

Habranthus tubispathus forma *bicolor* (Rav.) Traub, *comb. nov.* Syn.—*Habranthus tubispathus* ssp. *variabilis* var *bicolor* Rav. Plant

Life 26: 103. 1970. Tepals white stained fulvous at the apex.

Other variations such as larger flowers and most of those recognized by Herbert in 1837 should be included in the parent species.

Ravenna has recently studied this species in detail and he is to be commended for bringing order out of chaos. His treatments are to be found in Plant Life 26: 99-103, fig. 25. 1970, and Plant Life 30: 49-50. 1974. When he has completed his study a realistic picture will be presented.

1974 ZEPHYRANTHEAE REPORT

MRS. MARCIA CLINT WILSON, *2719 Palm Circle West, Galveston, Texas 77550*

Several genera among the Zephyrantheae know no season for bloom, even though they are supposed to be programmed for bloom during set seasons of spring, summer or fall. In the literal sense, certain *Zephyranthes* and *Habranthus* species and hybrids might, with no special treatment, have isolated bloom any month of the year in a warm climate (or in a greenhouse situation). Since this may vary among different clones from year to year, I have long suspected that some of the unscheduled flowers are from offset bulbs blooming for the first time. While this is not a complete explanation, we may now add *Sprekelia* to these unpredictable genera (see special *Sprekelia* section in this report).

In another sense, there are batches of Rain Lilies blooming somewhere in the world at all times, under normal growing conditions and schedules. Interest in these bulbs is still keen the world over. In Australia, the seasons are directly opposite to ours. See Lindsay J. Forbes' separate report in this issue. In England, one collection is being successfully grown in sandy beds under glass, with temperatures in winter kept at least above 32° F. Some growers in our coldest climates in this country use flats, or any synthetic substitutes like styrofoam chests, which may be placed in a basement for the cold period. A great number of the *Zephyranthes* and *Habranthus* maintain root and leaf growth during fall and winter months and go dormant or semidormant in the spring (they may flower without leaves). While most can stand forced dormancy by being dug and dried off for several months, I'm sure that many evergreen Zephyrantheae would need small amounts of extra attention once root and leaf growth is reestablished in the spring. I would be interested in learning more on this subject—which species and hybrids store and later perform best, etc.

The Zephyrantheae are also still high on the list of desirable plants for various scientific studies. Apomixis has been studied among certain species and this subject is now being broadened to include other crossing incompatibilities between species and closely related genera. Cytological work still continues with both newly introduced species and hybrids among species and between genera—the more complicated the hybrid,

the more interest in studying it. Taxonomic studies are currently more concentrated in South America, with the dedicated work of Sr. P. Ravenna. Plant collecting expeditions are continuing and individual reports appear from time to time in PLANT LIFE. Other expeditions made by public and private funded institutions (and individuals) may not always receive wide publicity, but amaryllids that are found usually reach the proper people for study and possible introduction. Several of the current scientific studies have been aided in one way or another by members of APLS.

The late Alex Korsakoff set a good example with careful record keeping with hybridizing attempts among Zephyrantheae. He kept his record system simple enough to keep current at all times. Partially because of built-in handicaps such as apomixis, hybridizing among *Zepryranthes* and *Habranthus* species and between the two related genera is still in an "infant" state. Mr. Korsakoff left a legacy of successful hybrids for both scientific study and public enjoyment. All of my correspondence indicates that everyone is keeping careful records of crosses . . . keep it up! One never knows when a certain set of circumstances will produce a hybrid when all others have failed.

Please note that the plant species known familiarly as *Habranthus andersonii* (and varieties *cupreus*, *roseus* and *texanus*) is now *Habranthus tubispathus* (L'Her.) Traub. (See Dr. Ravenna's "Contributions to South American Amaryllidaceae", PLANT LIFE 1970 and 1974.) Somehow this change to a prior correct name missed my attention and I am pleased to recommend a thorough reading of the reference material mentioned. This is a most variable species in both color and size. Even the Texas Copper Lily (Syn. *Hab. texanus*, etc.) thought to be introduced many years ago from South America, varies in degree of coloration between collecting sites of College Station and Corpus Christi, Texas. The most distinct flower is forma *roseus*, which Dr. Traub has distributed widely with seeds. A number are blooming in my garden as I write and they popped up almost without a bud stage. Ravenna classifies this (1974 PLANT LIFE, page 19) as *Habranthus variabilis* (Rav.) comb. nov. [See also the brief note by Dr. Traub on *Habranthus tubispathus* which precedes this report.]

SYNONYMS—COOPERIA

What question would you expect to be asked most often about Zephyrantheae? From the experience of others and my own, it is "What is the difference between *Zephyranthes drummondii* and *Cooperia drummondii?*" While both are white *Cooperias*, they are not the same species and their main differences may be easily determined.

Zephyranthes drummondii D. Don (Syn. *Cooperia pedunculata* Herb.) is extremely robust, with comparatively large bulbs and wide (somewhat flat) grey-green leaves that grow quite long. The fairly large white blooms usually appear following spring rains and are borne on tall stout scapes. Flower petals are usually rather broad and may

have a slight crepe texture. This species may be found in Texas, New Mexico and northern Mexico, usually in limestone hills. The long-necked bulbs usually grow quite deep, even in a garden situation.

Cooperia drummondii Herb. (now *Zephyranthes herbertiana* D. Dietr.) (See Dr. Traub's note later in this section and Table I.) has a medium-small bulb with narrow somewhat thick green leaves, slightly channeled. Although variable in size and form within one field or between localities, the flowers are usually rather small with pointed concave petals that may not open wide. This species is probably the most fragrant of all *Cooperias*. It was their size, poor form, fragrance and ubiquitousness that prompted my family to nickname them "little stinkers." Later they saw under perfect blooming conditions some really beautiful forms. These were not only growing around Rio Hondo, Kingsville and Corpus Christi, but in Brownsville too. The white flowers usually appear from mid-summer to fall. Of all Zephyrantheae, this hardy species has the widest natural distribution. It is mostly found in Texas, adjoining states of Louisiana and New Mexico and in a number of spots in Mexico; however, it also extends as far as north as Kansas and down to South America. I have personally collected several specimens of this species in northeast Texas and was surprised to find that the bulbs were growing less than three inches in the soil. I have also grown the South American form (*Z. brasiliensis* Traub) from two different sources and have found it strikingly similar to our Texas native.

The above two species should not be confused with another white *Cooperia Zephyranthes traubii* (Hayward) Moldenke (syn. *Cooperia traubii* Hayward). This species may be found close to the Texas Gulf Coast from north of Corpus Christi to Galveston. Bulbs that I have collected in Galveston have been smaller than *Z. herbertiana* D. Dietr., with more narrow leaves. The scapes are tall and slender and the flower tube is quite long. The flowers may vary in size, but I would call them refined "open stars." The petals are rather narrow and evenly arranged. The diameter of the stigma is quite small and its length is as exaggerated as the flower tube, extending well beyond the erect, clustered stamens. Field variations in length and diameter of style and size of stigma may occur. While delicate in over-all appearance, the flowers last as well as any relative. In our area, the bulbs grow deep and the necks are long. Under ideal conditions, this species has the longest bloom span of all *Cooperias;* however, heaviest bloom usually appears with *Z. herbertiana* in the wild. So many of the *Zephyranthes* and *Habranthus* described as "white" are often flushed with pink in the bud stage--this may be more pronounced upon withering. One exception that quickly comes to mind is the cute little white *Z. albiella* from northern South America.

The need for changes in names of *Cooperia drummondii* and *Cooperia pedunculata* began again in our lifetime when Dr. Traub reclassified the genus *Cooperia* as a subgenus of *Zephyranthes* (See Amaryllid Notes page 41, 1951 PLANT LIFE and page 82, 1952 PLANT

LIFE). Because of the close crossing relationship (both natural and controlled) and many physical similarities between *Zephyranthes* and *Cooperia*, Dr. Traub did not feel the differences represented a distinct enough gap to warrant a separate generic designation for *Cooperia*. This meant that he had to rename all *Cooperias* as *Zephyranthes;* i.e., *C. traubii* to *Z. traubii*, *C. smallii* to *Z. smallii*, etc.). All was easy until it came to *C. pedunculata* Herb. It seems that this species had been named by D. Don as *Z. Drummondi* one year before Herbert described his *Cooperia pedunculata*. Going by interpretation of one of the rules of botanical nomenclature, *pedunculata* had to revert to the prior name assigned it by D. Don. This left *C. Drummondii* Herb. as an invalid name under Traub's subgenus and thus it became *Z. brazosensis* Traub in 1951. When Dr. Traub reviewed an early draft of this report, he pointed out that Dr. R. O. Flagg found an earlier name for this species under the genus name, *Zephyranthes herbertiana* D. Dietr. With Table 1, Dr. Traub asked that this correction be made.

Because I lack easy access to rare individual source material, I have secured permission to quote some interesting historical passages from Dr. R. O. Flagg's PhD Dissertation, INVESTIGATIONS IN THE TRIBE ZEPHYRANTHAE OF THE AMARYLLIDACEAE (The Alderman Library, University of Virginia, May 1961, page 25.). Dr. Flagg's present position is that of Director of Botany with the Carolina Biological Supply Co. The change in spelling of *Drummondi* to *drummondii* is one of those small developments of agreement in international botanical nomenclature. Some botanists prefer to use a capital in a species name honoring an individual person or a geographical location. Some of the morphological differences of *Cooperia* are also mentioned below.

"*Cooperia*.—This genus was established by Herbert (Feb. 1, 1836) with the description of *Cooperia Drummondi*, the type species, and a brief note on *C. chlorosolan*. The generic name honored Joseph Cooper, the gardener who brought him a flowering bulb of *C. drummondii*. The bulbs of this group had been sent from Texas to England by Thomas Drummond in 1834 (date *fide* Hume, 1938)."

"March 1, 1836, without having seen a living specimen, D. Don gave the name *Zephyranthes Drummondi* to another taxon from Drummond's collections. Shortly thereafter, R. Graham (1836) named the same plant *Sceptranthes Drummondi* in the belief that it was distinct from both *Zephyranthes* and *Cooperia*. Herbert (1837) dubbed this plant *Cooperia pedunculata*."

"In monographing *Cooperia* Hume (1938) . . . stated, "While *Cooperia is* related to *Zephyranthes* so closely that the two frequently have been confused and hybrids between them have been secured, it is to be separated from the latter genus by the longer perianth-tube, very short filaments, erect, not versatile anthers, scented flowers, and night-blooming habit." (It may be pointed out that some current workers—as Flory in his 1968 Zephyrantheae paper in THE NUCLEUS—still concur with Herbert and with Hume, and others, in considering *Cooperia*

different enough in critical characters to warrant its continued generic separation from *Zephyranthes*.)

I used Dr. Flagg's PhD Dissertation (Table 12, page 74 and Appendix II, II-I) as a reference in compiling the synonomy presented in Table 1. After Flagg, I omitted *C. miradorensis* Kränzl (1925). This was studied by Drs. Flory and Flagg in its native habitat of Vera Cruz, Mexico and found to be a *Zephyranthes* (as is the type specimen in the Herbarium of the University of Copenhagen). From information in a later publication by Dr. Walter S. Flory, *C. albicans* Sprague (1928) was deleted. This is confirmed by Flory as *Pyrolirion albicans* Herb. (1837). This paper, *Chromosome Diversity in Species and in Hybrids, of Tribe Zephyrantheae*, THE NUCLEUS, 1968, was also used as a reference for Table 2—along with some personal help by the author in interpreting certain somatic chromosome ranges.

TABLE 1. The recognized species of Genus **Zephyranthes**, Subgenus **Cooperia** (Herb.) Traub and synonymy.

Genus **Zephyranthes**, Subgenus **Cooperia** (Herb.) Traub	Synonyms
Zephyranthes brasiliensis (Traub) Traub (1951)	**Cooperia brasiliensis** Traub (1945)
Z. drummondii D. Don (1836)	**C. pedunculata** Herb. (1837) **Sceptranthes drummondii** R. Graham (1836) **C. oberwettii** Percy-Lancaster (1936) **nomen nudum**
Z. herbertiana D. Dietrich (1840)	**C. drummondii** Herb. (1836) **C. chlorosolen** Herb. (1836) **C. mexicana** Herb. (1837) **nomen nudum** **C. drummondiana** Herb. (1837) **Z. chlorosolen** (Herb.) D. Dietr. (1840) **Z. brazosensis** Traub (1951) **Z. brazosensis** var. **chlorosolen** (Herb.) Traub (1952)
Z. jonesii (Cory) Traub (1951)	**C. jonesii** Cory (1950)
Z. kansensis (Stevens) Traub (1951)	**C. kansensis** Stevens (1938) *
Z. mirrisclintii Traub & Howard (1970)	
Z. smallii (Alex.) Traub (1951)	**C. smallii** Alexander (1939)
Z. traubii (Hayward) Moldenke (1951)	**C. traubii** Hayward (1936)

* Some workers consider **Cooperia kansensis** synonymous with **Zephyranthes herbertiana** D. Dietr. (1840).

Somatic chromosome numbers reported for *Cooperia* are presented in Table 2. It will be noted that the numbers vary from a low of 24, in *Z. traubii*, to a high of 72—which is encountered among forms in several species. It will also be noted that the somatic chromosome numbers vary somewhat in one and the same species, in several cases. Particularly in *Z. herbertiana*, the range is from 48 through 55, 56, 58, 59, 60, 68, to 72. The number 48 is involved in about half of the taxa. It is also a common number throughout the genus *Zephyranthes*. It is evident that the numbers 24, 48 and 72 form an euploid series. The numerous anueploid numbers (53, 55, 56, 58, etc.) have probably developed from or are involved with either one or both of two separate phenomena: (1) apomixis; or (2) mitotic crowding. In at least some cases the higher chromosome numbers are apparently responsible for some of the stabilized "specials" or "superiors." An example is the popular large form of *Z. smallii* (Clint's collection number T-56) which

has 72 somatic chromosomes, rather than the 54 of the more usual, smaller-flowered type. In certain cases, where duplicate numbers have been noted by different individuals, the earliest reference is used.

TABLE 2. Somatic chromosome numbers for taxa of Genus **Zephyranthes,** Subgenus **Cooperia** (Herb.) Traub.

Species	2n	Reference
Zephyranthes brasiliensis (Traub) Traub	69 + 1f	Traub, 1945
	70	Flagg, 1961
Z. drummondii D. Don	48	Flory, 1939 a
	ca. 70-72	Flory, 1939 a
	72	Flagg, 1961
Z. herbertiana D. Dietrich	48	Flory, 1939 a
	55, 56, 58, 59	Coe, 1953
	48, 60, 68, 72	Flagg, 1961
Z. jonesii (Cory) Traub	48, 72	Flagg, 1961
Z. kansensis (Stevens) Traub (= **Z. herbertiana?**)	ca. 48	Flory, 1939 a
Z. morrisclintii Traub & Howard (1970)	unknown at present	
Z. smallii (Alex.) Traub	54	Flory, 1939 b
	53, 58, 70, 72	Flagg, 1961
Z. traubii (Hayward) Moldenke	24	Flory, 1939 a

SPREKELIA

When several people complained of slow growth of hybrid seedlings, poor bloom performance, etc., with certain *Sprekelia* forms and hybrids, I contacted my mother in Brownsville: "I'm surprised that your trouble queries came from California and the north. I thought it was just us southerners who had difficulties with *Sprekelia formosissima.* Remember that *Sprekelias,* which are native to Mexico and on to South America, choose a very special environment. They are nearly always high up in the mountains, or at least most of them we have seen. Apparently they don't normally bloom heavily in the wild or we would have seen more of them."

"Since we couldn't bloom them well here in the garden, yet bloomed them magnificently at the farm, I would say it is probably necessary to give them plenty of water and food during the late spring and summer growing season– even into the fall in warm areas." (Because of a salt problem which developed in the shade house at the Clint "farm", tile drainage was installed, with use of elevated beds and a special soil mix.) "Actually, at the farm we bloomed some of our hybrids during every month of the year by keeping them in good healthy growth through water and food (the bulbs got huge, which seems to be a necessary requisite here for frequent bloom)."

"Some wild forms are better bloomers than others and hybrids among these are superior. The one from Peru and 'Harrisons Orientred' are the best for this climate. Bulbs collected in the mountains near San Vicente, Hidalgo, Mexico bloomed very easily and were mostly evergreen. Those found just north of Jacala, Hidalgo, for some reason, did not thrive and were poor bloomers. We found this strange because these areas are just a few miles apart. We did not personally collect either of these and perhaps natural environment might be quite different. The worst performers here are the ones which natrually go

dormant in winter. These include *Sprekelia var.* 'Superba' and several I received from the late Len Woelfle in Ohio. Others are the one from Cuernavaca, a Guadalajara form and those from Morelia. The ones that do well do not necessarily thrive everywhere—this is particularly true of the Peruvian form."

When the Clint "farm" (experimental gardens) had to be abandoned, my mother "sifted sand" (literally, in many instances, in order not to miss some very small backward Zephyrantheae). The various bulbs, many without labels— only clues from locations dug—were planted in specially prepared beds adjacent to her home. Her *Sprekelia* are making a remarkable comeback. During the summer of 1973, Brownsville enjoyed an unusual abundance of rain which helped keep the soil temperature cooler. While a good mulch is a great garden aid in very hot climates, the cooling effect of the rainfall prompted my mother to shift many *Sprekelia* bulbs to a location with filtered sun. Please note what Dr. Howard has to say about soil temperatures further along in this section.

Dr. Thad Howard recently wrote to me on the outstanding performance of some *Sprekelia* hybrids. "My own hybrids from 'Harrison's Orientred' are very similar to this parent for the most part. The flowers have a bit nicer form to them and there are minor differences in the markings in the throat. I am convinced that if one wants to hybridize *Sprekelias*, 'Orientred' should be one of the parents. It gives more vigor and free flowering qualities than anything else. The Clint hybrids of Peru X 'Orientred' are wonderful too. These give the dark red shades and nice form plus free flowering. Mine yield the bright red shades in color contrast." (As if to prove itself, a bulb of 'Orientred' was in bloom for our Thanksgiving visit to Brownsville! Following good showers, this same group bloomed again in January and February.)

"I should someday like to see *Sprekelias* assume their place alongside *Amaryllis* in flower shows, with quality standards being set for the various classes on a point scale. There is enough variety among various clones (both species and hybrids) in *Sprekelia* to allow for this. Some good quality *Sprekelias* are show flowers and should be grown as such. They run through all the red shades, from pink through brick red, scarlet, crimson and even stripes. There are formal and informal types, giants and miniatures and they deserve recognition as such."

A while back I was lucky enough to receive a bulb of Howard's dwarf *Sprekelia*. (See cover of 1970 PLANT LIFE.) The bulb was no larger than a medium-sized *Zephyranthes* and the leaves were equally dwarf—narrow and only fairly long. When it went dormant in late December, it was mulched with peat like the rest of the Zephyrantheae. I checked for firmness periodically following minor cold spells, but it had completely disappeared by spring. The reported loss of the dwarf *Sprekelia* prompted some helpful cultural practices from Dr. Howard:

"Actually, this small bulb is an easy thing to grow in the warm

Fig. 17. ***Sprekelia formosissima*, right, clone 'Papa Gallo', and left,** a dark red form received from Peru. Photos by Dr. Thad M. Howard.

months. Wintering over in the ground is rough, even in warm areas. It is cold sensitive and bulb mites attack it. The best thing to do is winter inside in a flat or pot, or dig and store. Personally I think it is more apt to flower if kept in soil over winter; however, protection from bulb mites is more sure if dug and stored with a dusting of sulfur and Sevin powder mix."

"The dig-and-store method works on ALL *Sprekelias*, but not all require it. Hardiness with them depends on their point of origin. The northern forms are found at high altitudes, but as one goes southward below Mexico City, they are found at lower and much warmer altitudes and thus are cold-sensitive. In the wild, they bloom sporadically from late April through July, depending on rainfall. One would expect to find them in full bloom in May in San Luis Potosi or Hidalga States, but early July might be normal for them in Durango or Nayarit. Apparently the rains come later on the Pacific side than they do on the Gulf side of Mexico."

"Flowering *Sprekelia* can be simple or frustrating. The simple part is that good culture will result in large bulbs which will produce embryo flowers. The bulbs thrive in porous soil, rich in humous, with ample moisture supplied that can drain off quickly. The frustrating part is that some clones will abort their embryonic buds for one reason or another and rarely flower. Dig any non-flowering clone with a large healthy bulb and dissect it. You will find dried, black aborted buds in the outer coats and embryo buds forming toward the center. Just what prevents their flowering is a puzzle, but it could be that hot soil temperatures during the active growing season may be a reason. In areas with hot dry summers (like ours) and with soils that quickly bake, a good mulch could be beneficial. Or, it might be a reverse problem with cold winter soil temperatures during the dormant period. This might explain why some of these bloom better in colder climates where summer temperatures are a few degrees cooler and they are protected from cold soils by digging and storing. Whatever the reason, almost anyone can flower at least one or more of the many forms available from the various geographical areas where the genus is found. The solution is to grow as many clones as one can find and discover what does best in that particular garden."

PRELIMINARY REPORT ON COLOR CLASSES OF HYBRID **NERINE** CLONES

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At the request of Dr. Hamilton P. Traub, I am making this preliminary report as a member of the Nerine Committee in order to start the movement towards the elimination of the chaotic condition with reference to the great number of unevaluated hybrid Nerine clones. Dr. Traub's suggestion is summarized in the article in the 1974 PLANT

LIFE, page 88. The following is a preliminary contribution toward the evaluation of the clones now in my collection. An attempt will be made to evaluate all the clones added in the future. As suggested by Dr. Traub, the members of the Nerine Committee are expected to take the lead in evaluating the reported Nerine clones so that only the highest rating ones may be preserved and propagated, unless the inferior clones are of value in further breeding. Thus, the other members of the Nerine Committee are expected to evaluate the clones in their collections. Out of this he expects that the final list of high quality clones grouped by color classes will be obtained.

At present, I have about 324 Nerine clones, but only 224 of these are named clones.

Many of the clones bloomed this season (1973). I determined the color of the flowers but noted also the length and thickness of the flower scape (stem), and the number of flowers in the umbel. I used the Royal Horticultural Society, London, *Horticultural Colour Chart* (abbreviated, HCC). Only clones without virus infection were placed in color classes.

The results of the 1973 evaluations are listed in Tables 1 and 2. Clones recently received from New Zealand and not evaluated are listed in Table 3.

Table 1. Highest quality clones in each color class selected from listings in Table 2 as of 1973. Eventually, from 5 to 10 clones in each color class will be retained.

Light pink 'Mithras', 'Stephanie', 'Diana', 'Molly Dent'
Medium pink 'Lady Stirling Maxwell', "Stephanie x 'Mrs. Vivian' "
Deep pink "Stephanie x Lady Foster", 'Miss Carrington'
Light red—'Fay Trussler', 'Rotherside', 'Somerhill', 'Fothergillii Major'
Medium red 'Corusca Major', 'Lady Llewellyn'
Deep red 'Miss Cator', 'Timoshenko'

Table 2. Nerine clones in the writer's collection evaluated in 1973. See Table 1 for high quality clones.

Ia. LIGHT PINK

'African Queen'; 'Audrey'; 'Bunty'; 'Constance Cripps'; 'Countess Altmont x Mrs. Clark' (Norah Hamilton); 'Diana Oliver'; 'Hon. Mrs. Wynn x Miss Willmott x Bowdeni'; "Horsa'; 'Jackie Wren'; 'Julia'; 'King of the Belgians'; 'Mrs. Frith'; 'Miss Battye'; 'Miss Willmott'; 'Mithras'; 'Molly Dent'; 'Mrs. B. Battye'; 'Mrs. Stanton'; 'Mrs. Kingscote'; 'Pink Frills'; 'Saudersonii'; 'Stephanie' and 'Sheila'.

Ib. MEDIUM PINK

'Blenheim'; 'Doris'; 'Felicita'; 'Fuchine'; 'Lady Stirling Maxwell'; 'Stephanie x Mrs. Vivian'; and 'Stephanie x Curiosity'.

Ic. DEEP PINK

'Alma Moldenke'; 'Anne'; 'Bennet Poe'; 'Cape x Curiosity'; 'Miss Carrington'; 'Nena'; 'Rushmore Star'; 'Sarniensis'; and 'Stephanie x Lady Foster'.

IIa. LIGHT RED

'Aerolite x Lionel'; 'Arnhen'; 'Ben Hills'; 'Bowdeni'; 'Capel'; 'Cephus'; 'Desdemona'; 'Eddy'; 'Ethel Smith'; 'Fay Trussler'; "Fothergillii Major'; 'Lady Havelock Allen'; 'Mansellii'; 'Mrs. Barkley'; 'Mrs. Hooker'; 'Mrs. Kingscote x Curiosity'; 'Nancy Lashy'; 'Paula'; Rotherside' and 'Somerhill'.

IIb. **MEDIUM RED**

'Afterglow'; 'Angela Limerick'; 'Corusna Major'; 'Curiosity'; 'Gaby Deslys'; 'Hon. Mrs. Wynn'; 'Lady Llwellyn'; 'Mrs. Bromley x Countess Altmont'; 'Mrs. Cooper'; 'Queen Mary'; 'Sarniensis' and 'Alynis Londeon'.

IIc. **DEEP RED**

'Henrietta'; 'Hon. Mrs. Wynn x Mrs. Cooper'; 'Lady Eleanor Keane'; 'Lady Lucy Hicks Beach'; 'Lady Montague'; 'Lady St. Aldwyne'; 'Miss Cator'; 'Purple Prince' and 'Timoshenko'.

IIIa. **LIGHT ORANGE**

None.

IIIb. **MEDIUM ORANGE**

None.

IIIc. **DARK ORANGE**

'Stephanie x Mrs. Elliott x Lady Rankin'; and 'Viscountess Grey x Aurora'.

IVa. **WHITE**

'Lily White'; 'Chaste White'; 'Solent Swan' and 'Vestal'.

IVb. **WHITE WITH PINKHEART**

'King of the Belgians x Inchmary Kate'.

IVc. **GREYISH WHITE**

'Flexuosa Alba'.

These evaluations are only the first uneasy steps. In the future other features besides color will be taken into consideration such as flower stem length and thickness, number of flowers per umbel, blooming season, ruffling of florets, flower size, dormant season (vernalization), vs. evergreen plants, etc.

Table 3. Named Hybrid Nerine clones from New Zealand not evaluated to date.

'Rose Haze'; 'Battle Flag'; 'Snow Maiden'; 'Cheery Ripe'; 'Salmon Decor'; 'Pink Satin'; 'Pink Ice'; 'Rose Glow' 'Orange Brilliance'; 'Star Gaze'; 'Sunset Frills'; 'Cheerfulness'; 'Brushfire'; 'Dazzler'; 'Peach Beauty'; Flame Brilliant'; 'Spectacular'; 'Rosy Glisten'; 'Flicker'; 'Pink Perfection'; 'Flamenco'; 'Tango'; 'Frilled Lass' and Lovely Lady'.

AREA DEVOTED TO NERINE CULTURE IN THE NETHERLANDS

G. A. M. Zuidgeest, *Netherlands*

During the "boom" in the growing of cut flowers from bulb plants in the Netherlands for some years past, the emphasis has been mainly on Lilies, Iris, Gladiolus and Freesias. During these same years, Nerine cut flowers were of only moderate importance. However, within the past five years, the Nerine cut flower trade has multiplied

by a factor of ten. In 1973, more than 2.5 million Nerine cut flowers were marketed. They are forced and cut for market the year round, with naturally the greatest quantity in the autumn months.

The area devoted to Nerine culture in the Netherlands is about 40 hectares, and this promises to rise to more than 100 hectares in a few years. The present area by Nerine clones cultivated is as follows:

30 hectares *N. bowdenii*
6 hectares 'Pink Triumph'
2 hectares *N. undulata (crispa)*
1 hectare *N. corusca major*
1 hectare other clones and species

AN APPRENTICESHIP IN ZEPHYRANTHEAE

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In the 1974 Year Book, one of our new Committee men, Richard E. Tisch, stated in the introduction to his report that *Zephyranthes* are easy in cultivation for reasons of easy shifting, good seed setting, fast germination, and for the short period from seed planting to flowering.

There may be many readers who wonder if he has over simplified the situation and so for the benefit of anyone who is considering whether or not they should start growing Rain Lilies, I thought readers might like to hear of some of my early experiences in trying to establish *Zephyranthes* is south eastern Australia—to be exact in Melbourne. In writing what I do I risk repeating what may have been written before. I am sure though, that there are many people, like myself, who take on a new interest and have very great difficulty in locating useful information which has been written in years gone past. I am a firm believer in periodical repeats of basic information, even though it may be elementary, in the hope of encouraging more interest for possible new adventurers in the Rain Lily field.

It was not so long ago that I had the opportunity of purchasing from the late Mr. Alek Korsakoff, a substantial number of *Zephyranthes* species and hybrids and a smaller number of *Habranthus* species and hybrids. At that point I realised I was just a novice without any help or local guidance and would have to provide their cultivation needs by trial and error (fortunately none of the latter occurred). I had several problems at that stage. The first was to get to know the bulbs—their growing habits—their growing cycle—their needs—their dislikes. In suddenly having over 100 different types of bulbs to look after, I found that it took a season or two until I could confidently give a name to the flower without referring to the label, and also to feel that I knew each variety for its own particular individuality. Not having a greenhouse my next problem was to risk planting the bulbs into garden beds.

knowing that they would not have the same natural growing conditions as they would have in their wild state in North and South America. I decided that it was a reasonable risk due to the fact that Melbourne's climate is a moderate one and we are not bothered by heavy frosts. Perhaps our climate is not quite warm enough, or humid enough to give perfect growing conditions, but results have shown that the climate is good enough. I had a nice sunny, warm and open position in which to plant them and I am fortunate in having light sandy loam which does away with any drainage problem—an important factor in any bulb growing.

After giving the bulbs a settling down period to acclimatize to their new seasons, I waited for flowers to appear. Sure enough after an early summer thunder storm, they were true to their name of Rain Lilies and I found some buds appearing. Another week found them out in flower and I was hurriedly taking notes of flowering dates and also recording descriptions when they were lacking from my records. I well remember the exciting experience of examining closely the first flower to open. It was *Z.* x *flaggii* 'Betsy'. This is a cross obtained by Dr. R. O. Flagg between *Z. atamasco* x Z. sp. K484 (from San Luis Potosi. Mexico-Hayward). Mr. Alex Korsakeff gave the grex name *flaggii* and named the individual special varieties resulting from this cross 'Betsy', 'Cathy' and 'Rick' for the Flagg children. Korsakoff later repeated this cross with good results. Perhaps I am prejudiced because this was the first bulb to bloom, but it is still one of my favourite *Zephyranthes* on account of its colour, being a beautiful soft shell pink, and on account of its study habit, good textured flower, and because it gives repeat blooms throughout its flowering period for about three months.

Having decided that I could really grow Rain Lilies in the southern hemisphere, I took confidence and decided to give them a healthy meal in reward for their first flowers. A liberal dressing of bone flour and farmyard manure did wonders and the leaves took on a very healthy and vigorous appearance.

I also found that without any assistance, many flowers set seed and I was obligated to keep a daily watch on their ripening progress, otherwise the pod would have burst and the seed would have been lost. At the first sign of yellowing, the pod was picked, carefully labelled and brought indoors to be placed in water for these last few extra days until the pod started to split.

The seed was then planted in an open potting mix comprising equal parts of loam, coarse sand and leaf mould. In later experience, the mix was also given a liberal dash of bone flour which forced young seedlings along beautifully. The pot was then placed in a warm sunny position for germination. Using fresh seed and having hot climatic conditions, almost complete germination took place within a few days. As the season progresses and the weather becomes cooler, pods take longer to mature and seeds can take up to three or four weeks to germinate.

The growing on of seedlings is a matter of ones own gardening instinct or preferred method. I prefer to plant out young seedlings within the maternal clump as soon as possible, but still bearing in mind climatic conditions.

Seed germinating in mid summer soon results in seedlings 2"/3" high and at this stage of growth they transplant so easily that it is difficult to note any setback in their continued growth. As summer gives way to fall, growth of freshly germinated seed is slower and in this case I prefer to leave planting of the seedlings until the beginning of next seasons growth. I found that *Zephyranthes* are better transplanted when in growth rather than when dormant. This observation is made in respect of bulbs grown in the open garden. Perhaps with greenhouse culture, transplanting when dormant may be equally satisfactory as one then can control the water during the stage the bulbs are lying dormant without a useful root system.

When I plant out the young seedlings the ground is given a liberal dose of bonemeal and the plants really thrive. I have had flowers from seed in 13 months. Again this is according to garden culture. Greenhouse cultivation may produce even better results.

Returning now to the mature bulbs already growing in an established fashion, I can report on a constant succession of flowers throughout the flowering season, which is from October to April in Australia. With the advent of fall, one can note that the bulbs have given up vigorous growth and they prepare to go into dormancy. In some cases all leaf growth dies away completely (e.g. *Z. atamasco* and *Z. verecunda*), while at the opposite extreme (e.g. *Z. candida* and its many hybrids) the bulbs are virtually evergreen.

By spring the growth is ready to start again for yet another season of feeding, flowering, taking notes, seed collecting, seed raising and seedling transplanting. I am sure no one will dispute the claim by Mr. Richard Tisch that *Zephyranthes* are easy to grow. The only weakness so far noted is the greed with which slugs, snails and other kindred kind devour their luscious foliage. There are good preparations on the market in these days to put a speedy end to these.

I believe that by now I have well passed my apprenticeship as a novice a very pleasing experience indeed, as *Zephyranthes* are little known in the state of Victoria.

My thoughts now revolve around what I can do next in the post-novice stage. I know that some eminent bulb growers in the U.S.A. have spent many years in hybridizing *Zephyranthes*, and much success has been achieved in this field, as well as in the field of bi-generic crosses with related genera. Some of these results are already in my own possession and they are indeed excellent plants. I have very much admired the work of these growers in developing good healthy free flowering hybrids in the yellow/copper tones, and some which I am glad to own are—'Desiree', 'Kitty Clint', 'Sunburst' and 'Texas'.

In spite of the good work of the past I have been tempted and have succumbed to the idea of indulging in some hybridizing of my own. I

have a vivid imagination and in the seedlings I can already see many "Hybrids of the Year" emerging. I hope that when the plants do eventually bloom I will not have to lose confidence in my imagination. I will certainly not have to wait long due to the very accomodating nature of these charming little bulbs, *Zephyranthes*.

ZEPHYRANTHEAE PROPAGATION BY CUTTAGE

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Using methods described in Plant Life and other related periodicals, you can propagate your choice Zephyrantheae bulbs by cuttage, without fear of disastrous loss. The techniques of asexual propagation by bulb cuttage have been refined to a point where losses of the cut bulbs are minimal. Increases in stocks of individual clones are accelerated to where the process is now economically feasible.

The practice of bulb cuttage in general reaches far back in history. Possibly the first knowledge of the phenomenon came about through accidental cutting of bulbs while digging. Surely there were not many changes in methods for many, many generations. Hollowing out the bulb up through the basal plate, criss-cross cuttage through the basal plate, halving and quartering the bulb through the basal plate, and partial slicing of the bulb from the top or side were all popular methods. Tradition, without experimental variation, seemed to govern the regional practices, the actual restrictive parameter being bulb loss from infectious rotting.

I. SOME PRIOR TECHNICAL REPORTS

Within the past 50 years the development of more effective fungicides and revised techniques for their usage have permitted changes in bulb cuttage practices. A review of some of the literature regarding cuttage of Amaryllids indicates that the importance of preventing fungous infection was possibly considered so widely accepted that some reports placed more emphasis on the control of other conditions.

In reviewing some of the reports along the route to today's practices, I have assumed that all experimenters considered this posture and took what they considered necessary precautions to prevent contamination of the subject growing matter. In this report I plan to point up some milestone reporting of experiments, then summarize elements of them which I consider important, and then describe some of my own experiments and results. Omission of other reports is not intentional; this report is not intended to be exhaustive.

In 1934 Traub reported (1) that cutting bulbs so that some were partially quartered half way through the root base and some were quartered the full way resulted in no significant differences. The cut areas were covered with paraffin, and the segments were placed in half sphagnum peat and half sand in flats.

Heaton, in 1934 (2), found great variation in individual seedling

clones' reactions to cuttage.

Both Traub (3) and Luyten (4) made important reports in 1935 on *Amaryllis* cuttage, with detailed step-by-step descriptions of the techniques used. Traub's report included his opinion that the best time for *Amaryllis* cuttage is after the bulbs have made their full growth following flower production—July through November. Luyten, in addition to her excellent coverage of the single-scale technique, which does not use all the basal plate along with the scales, stressed that maintenance of a constant flat or pan temperature at 86°F results in optimum bulblet production.

In 1936 Traub reported (5) that he had found the best medium for after-cuttage growth of *Amaryllis* to be granulated German peat, coarse sand and broken rock (¼" mesh) in equal proportions, plus good drainage. In 1937 he reported (6) on stem cuttage of *Ismene*, which resulted in formation of bulblets by 67% of the cuttings.

Also in 1937, Hume and Watkins, reporting on *Zephyranthes* propagation (7), stated that their experiments, performed when bulbs were in full leaf, included cross-cut, scooped, oblique-cut halved, quartered and eighthed bulbs. Although they concluded that cross-cutting and scooping had no particular value because bulbs so treated produced very few bulblets, they noted that cross-cut bulbs produced root systems more abundantly than they did before being lifted and cut, and suggested that such treatment might be valuable for rejuvenation.

Klotzbach, in 1957 (8), discussed hydroponic culture of *Amaryllid* bulbs, including the growth of cut bulbs in gravel.

In 1958 Davis reported (9) on the use of a modern fungicide for soaking cut sections of *Amaryllis*, and the use of vermiculite as a propagation medium. Hayward summarized (10) in a thorough analysis most of the then-recognized problems and potential solutions. He made special note of the fact that variations in growth rates and inherent vigor of individual *Amaryllis* clones are apparent in the survival of cut segments. He also stated that lower temperatures slow the propagation rate.

In 1959 Stewart described (11) a method of providing bottom heat electrically by thermostatically-controlled soil cable, set for ON at 69-70°F and OFF at 82-83°F. He used concrete sand, dipped the *Amaryllis* bulbs in Bordeaux mixture for a few hours, then cut the bulbs by the "twin-scale" method, with two layers of the scale attached to a fraction of the basal plate. Cuttings were soaked in water with vitamin B-1 added. The flats were sprayed regularly with insecticide and fungicide.

Corbett, in 1967 and 1968, reported (12) (13) on cuttage of *Lycoris*. Loss of segments occurred due to rotting even though they were dusted with a 2:1 mixture of Hormodin #1 and Fermate and allowed to dry for two days to promote conversion of the cut surfaces into corky tissue.

Cothran reported in 1973 (14) on the availability of Benlate, a

systemic Benomyl fungicide, casting a glow of hope over the segment-loss problem. Also in 1973 Ticknor described (15) his technique for twin-scale propagation of *Narcissus*. Two important elements of his work seem to rise up out of the rest of the report: he soaked the cut segments in a solution of Benlate (Benomyl); he sealed the treated segments in plastic bags with damp vermiculite, held at 72°F. He stated, "The magic ingredient in this experiment was, I believe, the fungicide Benlate." He also included in the bags some segments which had no piece of basal plate attached. Of these he said, "Although these slivers remained white with heavy substance, not a one of them formed a bulblet." On 109 segments placed in bags July 15, by September 22 there were 101 bulblets.

II. CUTTAGE EXPERIMENTS

Having performed many bulb cuttage operations over the past 50 years, since watching the skilled Dutch growers in my native Michigan scoop out Hyacinth bulbs and X-notch Daffodil bulbs, I knew that the chance of total loss by rotting became a restraining factor when you had a one-of-a-kind bulb. Only the more intrepid growers dared nick such a bulb to try to stimulate offset production; and usually that was done only out of desperation, if the bulb had failed to divide or produce offsets by inself.

Lately, however, the cited articles have convinced me that my chances of getting offsets from a one-and-only bulb were very good, provided I took reasonable care. That included the following steps: disinfection of all tools and hands (I don't smoke, so the danger from that source is lessened.); careful pre-sterilization of the medium in which the segments are to be placed; neat, clean slicing of the bulb and meticulous cutting of the slices so that each segment has at least two scales and a portion of the basal plate; soaking of the segments in a fungicide solution; placing the segments in the pan at about a 45° slant, with the concave surface downward; covering all but the tips with the growing medium; watering-in with more of the fungicide solution; maintenance of bottom heat at about 80°F, with ambient temperature at about 72°F, and with a moisture-retaining plastic lid or film covering; patience and prayer.

A. *Zephyranthes drummondii* D. Don. Through June and July of 1972 seedlings which had flowered were lifted and dried. In early August they were cut either into quarters or halves, base-cut up through the basal plate and partially into the bulb with two cross-cuts or a single cut, or side-cut with a single cut partially into the bulb and basal plate (see Fig. 18). Prior to cutting, my hands and the knife blade had been sterilized in a Captan-containing fungicide solution. A plastic pan contained two layers of growing medium: an all-soil layer in the bottom and then a layer of half soil, half vermiculite, each about 1½″ thick. The cut bulbs were soaked for about one hour in the fungicide solution, then placed atop the second layer so the pieces were standing upright, as when growing. A two-inch layer of vermiculite

was hand-sifted over the pieces, and all was again soaked with the fungicide solution. The pan was placed on one of my screenhouse tables, with two forty-watt Gro-Lux lamps two feet above, and covered with an inverted clear plastic shirt box. Bottom heat was not provided; ambient temperature ranged from 70-90°F daytime maximum to 55-65°F nighttime minimum.

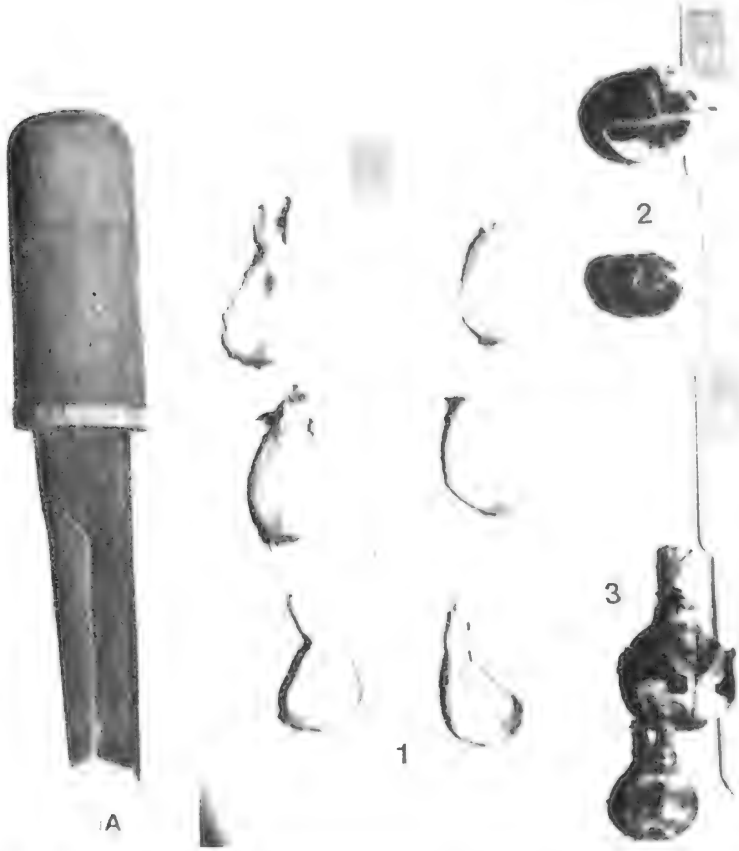

Fig. 18. Propagation of Zephyrantheae: (**A**) Bonasi knife used for cutting. (**1**) **top**, four quarters; **bottom**, two halves; (**2**) cross-cut up from base; and (**3**) side-cut part way through base.

By August 27 leaves were showing in four places. Surprisingly, a flower scape came up from one of the base-cut bulbs. In October the screenhouse panels were re-installed, and a thermostatically controlled electric heater was activated. Temperatures at tabletop level ranged from a high of 92°F to a low of 64°F.

On November 24 the segments and bulbs were lifted, examined and photographed (see Fig. 19). Results were as tabulated below. Two of the side-cut mother pieces did not develop bulblets.

Type of Cut	Mother Pieces	Bulblets
Segments	22	62
Base-Cut	8	43
Side-Cut	9	11

Normally the next step would have been separation of the bulblets and planting in a standard growing medium. In this case I wanted to see what would happen if they were replaced in the pan under the same propagation medium. Growing conditions were maintaind the and only the segments and base-cut specimens were replaced in the same propogation medium. Growing conditions were maintained the same as before lifting.

On May 14, 1973, when the heater was turned off and the screen-house panels removed, the specimens were again lifted, examined and photographed (see Fig. 19.). Of the 62 bulblets on the segments, only 44 remained; the mother segments had withered; only three still had leaves; 12 segments had only one bulblet; some of the bulblets had continued to grow and were very large. The base-cut specimens had increased the number of bulblets from 43 to 48; the mother segments had withered so that it was difficult to determine which groups of bulblets belonged together; six still had leaves; one specimen which held together had eight bulblets.

B. *Zephyranthes* X 'Marcia'. One bulb, described as Howard's hybrid Z. X 'Ruth Page' X Z. "sp. Valles", was sent to me by Marcia C. Wilson for use in cuttage experimentation. On October 15, 1973 the bulb was base-cut crosswise two places, dusted with a Captan-containing fungicide and set in vermiculite over a layer of soil-vermiculite mix in a plastic pot. Thermostatically controlled bottom heat from a cable was maintained around the clock, and two 20-watt Gro-Lux lamps were lighted 16 hours per day at 18 inches above the pot. On March 17, 1974 it was lifted and examined. No photograph was made, and my usually complete notes say merely, "Many offsets." Mother and bulblets were planted outdoors as a group. They were lifted and examined just now (July 17, 1974): the mother bulb had withered; there remains a hardened corky basal plate "crown" with strong roots, plus eight healthy rooted bulblets. All were separated and replanted, with the crown just below the soil surface.

C. *Zephyranthes* X 'Percy The Great'. One bulb, described as a Flagg hybrid which flowers frequently, was sent to me by Marcia C. Wilson for cuttage experimentation. On November 11, 1973 the bulb was treated the same as specimen B. above. On December 14, because there was no sign of leaf growth above the medium, it was lifted and

examined. There were signs of rot inside the cut area, so it was washed, re-dusted and laid on top of the vermiculite, exposed to the air. In the middle of one of the cuts, a bulblet starting to form was noted after washing the bulb. In January of 1974 a leaf was starting up from the mother bulb, so it was replaced in the propagating medium. On March 17 it was lifted, examined and photographed. The mother bulb had split and was beginning to deteriorate; one large bulblet had formed in the cut area, and four smaller bulblets were forming at the base of the large one. Mother and bulblets were planted outdoors as a group. They were just now lifted and examined: the mother bulb has

Fig. 19. Propagation of Zephyrantheae: results from **(A)** quarters and halves after 39 weeks; **(B)** base cuts after 39 weeks; **(C)** quarters and halves after 16 weeks, and **(D)** side cuts after 16 weeks. Photos by R. E. Tisch.

withered, and there are seven small to medium-sized bulblets, all growing leaves; there is no longer one bulblet exceptionally larger than the others. They were separated and replanted.

D. *Sprekanthus cagei.* In late November of 1973 Dr. Cage sent me two large bulbs, each with small offsets starting. Having had successes prior to then with cuttage of *Zephyranthes*, and having read and re-read the cited reports, especially Ticknor's report (15) on Daffodil cuttage, I was confident that cuttage could be performed successfully on a rare and valuable bulb such as these. (I did not inform John Cage

of my intent, feeling that there was no value in having more than one person worried about the outcome.) Being already convinced that a growing bulb was more likely to start producing bulblets without damaging delay. I potted the bulbs in sandy soil in plastic juice pitchers to start their normal growth. By January of 1974 leaves were showing above the soil, so the bulbs were lifted and examined. They looked healthy, with strong new roots well formed.

Taking all the usual precautions, but using a Benomyl systemic fungicide solution in the manufacturer's recommended proportions. I cut the largest bulb per the twin-scale method. I also washed my hands frequently: Ticknor had reported, "I will add at this point that I didn't wear rubber gloves but that I did wash my hands every 5 minutes." As much as feasible I handled the cuttings with a surgeon's long-nosed forceps. The fungicide solution was nearby in a glass bowl, and into it each cutting was placed. Cutting the bulb consumed about one hour, and the cuttings were soaked for another hour. Possibly because of its fresh new-growth condition the bulb was tender, and I ended up with 17 twin-scale cuttings and 38 single scales (cuttings which had separated).

Vermiculite was wetted with the fungicide solution and placed in a transparent plastic bag, then the cuttings were carefully distributed throughout the vermiculite, that bag inserted into another clear plastic bag, and the bag openings closed over and stapled closed. The package was placed directly on the top Floracart tray in my study. The tray's sets of two 40-watt Gro-Lux lamps were turned on for 16 hours per day, with the top tray 12 inches below its lamps. A thermometer set on the top tray near the package indicated an ambient temperature of from 80°F during the daytime to 70° at night. The higher daytime temperature resulted from the slight heat generated by the lamps suspended just below the top tray.

It was noted that extensive exudation of fluid occurred from the cuttings as soon as cuttage began. This bleeding apparently continued while the cuttings were soaking, because the fungicide solution was noticeably thicker after removal of the cuttings. There is no evidence to suggest that this bleeding was detrimental, unless it weakened the single scales by bleeding from the severed ends where they were torn loose.

On March 18 (60 days after cutting) green growth could be seen through the plastic bags, so they were opened and the contents examined and photographed. The 17 twin-scale cuttings were all forming bulblets, between the scales only, with two cuttings forming two bulblets each and one forming three bulblets, for a total of 21 bulblets. On the single scales there were no bulblets starting.

The bulblets, with scales still attached, were planted in a standard Rain Lily soil mixture in a plastic pan, which was placed on the same tray in order to provide bottom heat. The single scales were returned to the inner plastic bag, which was replaced on the tray. Since the

leaf growth on the removed bulblets was very pale, the outer plastic bag was removed to increase light transmission to the scales. In another 30 days the bag was reopened and the contents examined: there was no evidence of the formation of the scales, which had shriveled markedly. These scales were discarded. In May the pan containing the bulblets, which by then were sending up strong leaves, was moved to the screenhouse with no supplemental heating, but with Gro-Lux lamps two feet above the pan. In mid-July the 21 healthily growing bulblets were lifted from the pan, photographed and transplanted to an outdoor bed.

E. *X Sydneya 'Easterlyi'*. From seeds received in 1969 from Russell H. Manning several vigorous clones were grown and used in breeding experiments. In March of 1974, following the technique suggested by Klotzbach (8) five representative clones were soaked in a Benomyl solution, cut and laid at close to a 45° slant barely below the surface of a coarse-fine gravel mix in a plastic pan. All pieces were placed with the concave surface, the point of the wedge, or the flat face downward. The pan had a solid bottom except for one drain hole drilled in one corner. The pan was placed in the screenhouse, with no supplemental heating, but with Gro-Lux lamps two feet above the pan. Sticks were placed under one end and one side of the pan so that it was tilted enough to drain out the single hole into a bucket below the table. The pan was initially and subsequently watered with a solution of 7-6-19 Hyponex in tap water. On July 16, 1974 all were lifted, examined, cleaned of withered and dried scales, and photographed.

1) *XS6901*. Soaked 10 minutes. Quartered and sectioned one large bulb into eight pieces. Halved one small offset. Some roots were left on outer pieces as well as on inner pieces. Result: all bulblets small; five of 10 pieces produced a total of 12 bulblets.

2) *XS6902*. Soaked five minutes. Quartered and sectioned one small bulb into eight pieces. Roots were left on the inner pieces only. Result: all bulblets very small; three of eight pieces produced a total of three bulblets.

3) *XS6903* (vigorous grower and prolific producer of offsets). Soaked 10 minutes. Quartered one large bulb and two medium-large bulbs; did not section. Halved three medium sized bulbs. Result: most bulblets large and strong; 18 of 18 pieces produced a total of 71 bulblets.

4) *XS6905XL* (extra large leaves, scapes and flowers; does not normally produce many offsets). Soaked 35 minutes. Halved two large bulbs and one medium-large bulb; did not section. Result: bulblets medium-large; five of six pieces produced a total of nine bulblets.

5) *XS6907* (good grower and bloomer, but does not normally produce many offsets). Soaked 30 minutes. Quartered and sectioned one large bulb into eight pieces. Quartered three medium sized bulbs; did not section. Result: bulblets medium small, with three very small

bulblets; 11 of 20 pieces produced a total of 24 bulblets.

III. CONCLUSIONS AND SUGGESTIONS

As usual, my experiments involve limited-size experimental lots and do not include comparative "control" specimens treated differently in some significant respect. Nonetheless, I do see trends which confirm the data previously reported by other experimentors and suggest that future expansions of these experiments will be valuable.

A. The use of a systemic fungicide such as Benomyl apparently increases bulblet production markedly by reducing the incidence of rot on the cuttings. Treatment of the propagation medium, the experimentor's hands, cutting tool and cut specimens seems to deter rotting until after the specimens have produced bulblets.

B. Base-cut bulbs may be placed in the propagation medium at normal planting depth. Segments and scales should be placed just below the top surface, slanted, with concave or cut surfaces downward. Once lifted from the propagation medium, bulblets should be separated from the cuttings if large enough, or cuttings with small bulblets attached should be planted in either a fresh sterile propagating medium or in a sterile growing-on medium.

C. The twin-scale technique seems best for maximum bulblet production; there should be two or more scales to each cutting, attached to a piece of the basal plate. The base-cross-cut technique seems adequate for stimulating growth from a bulb which has come to a standstill or seems reluctant to produce offsets. The mother bulb is thus not immediately destroyed, and leaf growth continues.

D. Luyten's emphasis (4) on the criticality of temperature control for mamixum bulblet production and fastest growth, also discussed by Stewart (11) is readily confirmed. Low temperatures result in reduced bulblet production and in accelerated rotting of cuttings. Bottom heat of 70-80°F seems best, with ambient temperature of 65-75°F advisable.

E. Currently I prefer vermiculite for the propagation medium, with a soil-vermiculite mixture under the vermiculite if the cuttage specimen already has growing roots. Watering with a fungicide solution is recommended, with use of a nutrient solution withheld until active leaf growth is evident. I'm not sure that the use of a fungicide solution precludes the addition of growth stimulating chemicals such as Rootone, or Vitamin B1 as used by Stewart (11).

F. More work is needed to determine the best time in the life cycle of various plants for cuttage. My results indicated that the best time to cut Zephyrantheae bulbs is during a period of foliage growth, usually prior to flower production.

G. Traub's coating of cut surfaces (1) suggests a possible approach toward reduction of bleeding which occurs after cutting the bulb. Dusting and drying of cut surfaces as described by Corbett (12) (13) might well be tested on some pieces of a bulb versus other pieces of the same bulb not so treated; possibly the use of Benomyl powder would

prove more effective than the powders he used. Further, a valuable investigation might be one which incurred the use of a "cauterizing" agent on the cut surfaces.

H. As Heaton suggests (2), evaluation of techniques should include the consideration that clones differ in the natural production of offsets and in their reaction to cuttage. These are not the same consideration; frequently one might want to cut a bulb which naturally does not produce offsets readily; however, that bulb, normally reluctant to divide or produce offsets, may produce many strong bulblets from its cuttings. For experimental purposes, it might be well to compare the results of different clones, using identical techniques and conditions. Ticknor reported (15) the results of cuttage simultaneously on five different varieties of Daffodils, with identical treatment, which indicated that his method was successful on all five types.

I. My experiment with cuttings grown hydroponically in gravel did not include bottom heat or ambient temperature control. Nor did I rinse the cuttings periodically with a fungicide solution after setting them. This type of experiment should be repeated under better conditions. Possibly the use of glass beads or marbles should be rechecked; when I last used small beads (1/64 inch diameter) they stayed too wet, which might not occur with larger ones. Full-sized bulbs of *X Sydneya* which are in gravel in plastic pitchers are flourishing.

J. Experimentation with different gaseous atmospheres, plus different pressures, might yield valuable information. The test equipment could be small and relatively inexpensive. Possibly rotting can be further reduced by use of a sterilizing or neutral gas. Carbon monoxide baths, for example, might accelerate the formation of bulblets and the start-up of root and leaf growth.

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PLANT SCIENCE: AN INTRODUCTION TO WORLD CROPS, by Jules Janick, Robert W. Schery, Frank W. Woods & Vernon W. Ruttan. Second Edition. W. H. Freeman & Co., 660 Market St., San Francisco, Cal. 94104. 1974. Pp. viii ; 740. Illus. $14.50.—This attractive second edition of an outstanding text will be welcome. It is written to give attention to the scientific, technological and economic foundations of world crop production. In this generously illustrated text, the subject is developed under the following main headings: plants and men, nature of crop plants, plant environment, strategy of crop production, industry of plant agriculture, and the market place. An appendix of conversion tables and an index complete the volume. Very highly recommended as an introductory course in plant science, agronomy, world food, economic botany, agricultural economics, and to those engaged in crop production.

SUNSET BOOKS PUBLISHED IN 1974: All are priced at $1.95 and generously illustrated. These may be obtained from Lane Magazine and Book Co., Menlo Park, Cal. 94025. **HOUSE PLANTS.**—This book provides the latest information on the aesthetics and care of indoor plants. A comprehensive selection guide alphabetically lists over 150 plants that can successfully be grown indoors. An informative text identifies each plant, its growth habits and care requirements. **SUNSET IDEAS FOR HANGING GARDENS.**—Over 150 kinds of plants that grow attractively in containers are listed for easy reference by both their botanical and common names. Included are a wide selection of house plants, as well as common outdoor landscape and bedding plants. There are tips on how to care for each plant. **HOW TO GROW ANNUALS.** With the help of this book you can select just the right plants to bring maximum color to your garden in minimum time. The encyclopedia section describes the popular annuals and some attractive lesser-known types. Information on each annual includes planting times, cultural requirements, flower descriptions, and suggestions for using and combining them in the garden or containers. **LOW MAINTENANCE GARDENING.**—This is here defined as planning the initial stages so that the end result will be a source of pleasure and relaxation. The required techniques are here explained, such as mulching to keep down the weeds and watering, and planting to minimize pruning, disease and plant failure. **GARDEN POOLS, FOUNTAINS AND WATERFALLS.**—The colorful water lilies and goldfish can be raised in your backyard pond as explained in this book. The bulk of book is concerned with many ideas for using the water garden to create a cool retreat for all the family and guests. Location, design and installation are

discussed. A special chapter is concerned with the building and maintenance of waterfalls, and pools. **ATTRACTING BIRDS TO YOUR GARDEN,**—Thirty-three popular garden birds are described and pictured. Directions are given on how to attract them, and maps provided showing their ranges. Birds that occasionally visit the garden are described. There are sections on supplementary feeding and care; bird houses, plants the birds like the most, and a suggested reading list, and an index. All of these profusely illustrated books are highly recommended.

BEAUTY RECIPES FROM NATURAL FOODS, by Anne Marsh. Sterling Publ. Co., 419 Park Av. So., New York City 10016. 1974. Pp. 48. Illus. $3.50.—This book is concerned with simple ingredients which when used alone or in combination with others, will produce beauty aids ranging from tooth powder to shampoo, and hair preparations. The needed ingredients are to be found in the well stocked kitchen; the needed herbs and flowers may be gathered in the garden. Recommended to all interested in cosmetics.

CORN-HUSK CRAFTS, by Margery Facklam & Patricia Phibbs. Sterling Publ. Co., 419 Park Av. So., New York City 10016. 1973. Pp. 48. Illus. $3.50.—The authors give directions for the use of corn or maize husks in the manufacture of dolls, small christmas trees, ceremonial masks, wreaths, mats, baskets, birds, lambs, dogs, and flowers. Highly recommended to all interested in home crafts.

GOGRAPHIE FLORISTIQUE DU QUEBEC/LABRADOR, by Camille Rousseau. International Scholarly Book Service, Inc., P.O. Box 4347, Portland, OR 97208, 1974. Pp. xxii + 799. Illus. $20.00.—This book enumerates, describes, and provides a map showing the distribution of the species of vascular plants found on one of the largest land masses in Canada, the Quebec-Labrador Peninsula of Northeastern Canada. This extensive and monumental work of about 800 pages, should be useful to all students of the Canadian flora who read French. There are short discussions of the geology, and the 7 bioclimatic zones found in the area. A lengthy discussion of the theories of phytodistribution as applied to the area is an added feature. There is a bibliography of about 969 entries and an Index. —**Thomas W. Whitaker.**

MOSSES: UTAH AND THE WEST, by Seville Flowers; edited by Arthur Holmgren. Brigham Univ. Press, 205 Univ. Press Bldg., Provo, Utah 84602. 1973. Pp. xii + 580. Illus. $14.50. This generously illustrated text contains the lifetime research of the late Dr. Flowers in bryology. The introduction deals with morphology, ecology and distribution, collecting, herbarium and study methods. The rest of the book consists mainly of the descriptive catalog. Following the key to the families and genera of the Class Musci, 18 families, 77 genera and 258 species are described in detail. A map of Utah, glossary, and genera and species index complete the volume. Very highly recommended to all interested in mosses.

ISLAND BIOLOGY, by Sherwin Carlquist. Columbia Univ. Press, 562 West 113th St., New York City 10025. 1974. Pp. ix + 660. Illus. $25.00—This fascinating book with 400 illustrations deals with the evolutionary patterns of island life, based on the author's direct observation and experimentation. Beginning with the citation of the twenty-four principles of dispersal and evolution, the author discusses long-distance dispersal; adaptive radiation; radiation in the Hawaiian Islands and other oceanic islands, and in southwestern Australia, and continental islands areas; insular woodiness, loss of dispersibility in island plants and animals, equatorial highland biota and selected island topics. Indices of biological names, and subjects complete the volume. This is surely an indispensable reference source for students and research workers in these areas of the biological sciences. Very highly recommendd to all biologists.

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GROWING AGAVES IN PENNSYLVANIA

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Agave Havardiana Trel. #2323 and #2324

This *Agave* is an endemic to the Big Bend region in Texas. When my mother Mrs. J. Norman Henry (Mary G.) first found it there, she admired the decisive glaucous blue foliage as well as the distinctive and bold character of the growth. It appealed to her so much that she could not resist bringing back a young plant or offshoot. It was not likely that it could weather our Pennsylvania winters, but then she forever believed in trying. Upon her return, I went down to the "desert" with her to set the young plant in the new and foreign environment. As she placed the start in the gritty mixture, she turned to me and said with a twinkle in her eye, "Well, it should be fun to see what it will do. Wouldn't it be a joke if it ever bloomed. Certainly, I will never see it flower but then, dear, you may".

How sad it is that she never lived to see the giant asparagus-like stalk rise from the rosette of wicked foliage to bloom. At times it rose as much as fifteen to twenty centimetres from the leaf mass between one day and the next. It was so exciting to watch the progress and finally, when the buds began to show and spread out in a series of flat umbels in candelabra manner, our impatience grew. In time the sulfur yellow flowers of the upturned inflorescence opened on a glorious blue-sky day. Our breaths were really caught! Not meaning to demean so remarkable a display, it must be admitted that I was reminded of yellow bristled scrubbing brushes placed bristle side up in the sun to dry. We all admired this remarkable contribution from Texas, as did numerous visitors, and wondered daily as it continued to grow until it reached the astonishing stature of four metres and forty centimetres! No doubt the excessively heavy rainfalls of the summer of 1972 gave the impetus for such a height in this climate. In Correll and Johnston's book *Manual of the Vascular Plants of Texas* they give the height in Texas as up to five metres.

Alas, I finally caused the already leaning column of near telegraph pole dimensions to crash by taking down an unwanted *Robinia* nearby which turned and caught one of the flower branches. The basal rosette, of course, had been improverished and expended at the end of its life cycle. There was a wild rush to prop the stalk up so it could continue to stand. Several weeks later we severed and placed the whole stalk under cover outside the barn where it would be in some measure protected from severe extremes in temperature at night as the seasonal chills of autumn descended. With members of this family there is enough food stored in their stalks to support the development of the seed. Luckily, this was the case! Some of the seed finally ripened, and we now have four young making a start for who knows what!

Agave Virginica #1395

This *Agave*, #1395, was planted in our Rock Garden about 1939 and has flourished happily ever since, seeding with adequate generosity to give the impression that *A. virginica* was an original resident. In fact, although it does not give a colorful display, the tall, slender spikes of modest green bloom lend grace to the scene as well as upward accents in contrast to the great rounded boulders of Baltimore gneiss. It is never in the way and not invasive, and it is a simple matter to rogue out those not wanted where the seed alighted successfully. Originally these were purchased through the Clement's Nik Nar Nursery. They collected them near Turkey Creek, South Carolina.

The blossoms are sparsely spaced along the spike, and each individual lasts but a day or two. Being green, the petals themselves offer little in the way of ornamental beauty, but the stamens and stigma show a bit more. At the approach of dusk the scent increases to entice the night flying pollinators. It is too bad to have this blessing so far from a house, but then perhaps the daytime display is not adequate to feature upon a terrace where the evening breeze could bring it to your attention. The foliage consists of a basal rosette which is rather close to the ground. Each leaf is broad at the base and tapers the length. Some of those here bear leaves which are spotted brown, and this is indeed a handsome feature to so otherwise drab a plant. In addition, the margins are rougher. As the seed capsules mature, their roundness is attractive, indeed more so than the flowers.

Agave SP. #632

There is another *Agave* species without a name and without a source which has resided for some thirty years in our Rock Garden, but in all that period it has never even attempted to bloom. At one time my mother had all the offsets cut free of the larger rosette in the hope that efforts would be concentrated on the production of a flower spike in the central rosette. This was to no avail. The rosettes are relatively prostrate and very glaucous and rigidly spiny. It has decorative value, but heaven help one while weeding about the beautiful foliage!

Two other species of small *Agaves* from the southwest, one from Texas, have been tried in the Rock Garden, but they have both failed. However, another trial of more from the southwest will be made. Should it be possible to have them get a good start one season, there is a better chance. Should a humid summer follow their planting out and either a wet winter or an unusually frigid one ensue, there is scant chance of their being happy enough to survive.

Agave SP. #2325

Another *Agave* growing here, #2325, is slightly larger than the foregoing one, #632. It has lived for some fifteen or so years in our "Desert Garden" in company with *A. havardiana*. This appears to

increase in size slowly as time passes so there is a chance that we may have another surprise. This one receives winter cover against excessive rain and wet.

SAPONINS ABSENT IN **HEMEROCALLIS** L.

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Recently Traub (1973, 1974) separated the usually saponin-free Order Amaryllidales [see Hegnauer, 1963, Amaryllidaceae, pp. 56, 67; Alstroemeriaceae, pp. 52-53; Hypoxidaceae, pp. 235-236; Velloziaceae, p. 448; Pontederiaceae, p. 421; Haemodoraceae, see Table 1. Traub experiments in present paper with *Anigozanthos viridis* Endl.; and Philydraceae, see Gibbs, 1974, Vol. III. p. 1931] from the more or less closely related orders usually containing steroidal saponins and sapogenins- *Liliales* (see Hegnauer, 1963, Lilioideae, pp. 277-279; Scilloideae, pp. 329-330); *Dioscoreales* (see Hegnauer, 1963, pp. 136-144); *Agavales* (see Hegnauer, 1963, pp. 27-31); and *Alliales* [see Hegnauer, 1963, Alloideae, pp. 315-316; 323; and Traub (1972) for the presence of laticifers and other characters of importance in delimiting the Alliales].

Table 1. Testing for steroidal saponins by the **stable-foam** method (See Gibbs, 1974, Vol. I. pp. 78-79).

Species	Order	Depth, ml. stable foam	Presence of saponins
Beschorneria sp.	Agavales	4.0	positive
Hesperaloe parviflora Torr.	Agavales	4.0	positive
Tulbaghia violacea Harv.	Alliales	0.5	doubtful *
Urginea scilla Steinh.	Liliales	0.3	doubtful *
Xanthorrhoea sp.	Liliales (?)	0.0	negative
Amaryllis divifrancisci Card.	Amaryllidales	0.0	negative
Hemerocallis washingtonia Traub clone 'Golden Ring'	Amaryllidales	0.0	negative
Anigozanthos viridis Endl.	Amaryllidales	0.0	negative

* Apparently a more refined method is required to determine if minor amounts of saponins are present.

The monotypic Family Hemerocallaceae (type,—*Hemerocallis* L.) could not be placed because no reports on the presence or absence of saponins were known to the present writer previous to 1974. The purpose of the present paper is to place this group in its proper order—*Liliales* or *Amaryllidales*—on the basis of the presence or absence of saponins.

Using the *stable-foam* test for saponins described by Gibbs (1974, Vol. I. pp. 78-79), an attempt was made to supply the missing information as far as possible at this time. This *stable-foam* test is here standardized further:—0.25 gm. of fresh plant material (leaves in this case, but other parts may be used as required) was finely chopped, placed in a 25 ml. pyrex glass volumetric flask; 5 ml. water were added and the contents were boiled for 1 minute, and cooled. The liquid was poured into a small glass-stoppered 10 ml. test tube (with an ap-

proximate 1 cm. inside diameter, and graduated in ml.) and shaken vigorously for 1 minute and set aside for 5 minutes.

A *stable-foam* 2 cm. or more in depth is considered to be positive for steroidal saponins. A lesser amount remaining after the 5 minute interval is considered doubtful, and no stable foam to be negative for steroidal saponins. The results obtained from the experiments are given in Table 1. The plants tested other than *Hemerocallis* are included as controls, particularly species of *Agavales* which are very rich in saponins.

According to these experiments, the genus *Hemerocallis* L. belongs with the saponin-free Order Amaryllidales as indicated in Table 1.

AN URGENT APPEAL

As is shown in the above example, a concise text devoted to the standard physical and chemical methods of analysis—"Standard Lineagic Methods"—for the lineagicist is very urgently needed so that our work may be built upon a common basis. The term *lineagic* (see Traub, 1964) is used since it implies that underlying all our work are the unifying principles of organic evolution. We are not classifiers or taxonomists (terms used also in other fields) of things in general, but are first of all evolutionary biologists and our groupings grow out of our relevistic insights into the evolution of living things, the evolution of very gradually changing lineages with time.

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BOMAREA, A NEGLECTED SUBJECT

William D. Bell,

Fairchild Tropical Garden, 10901 Old Cutler Road, Miami, Florida 33156

It would seem that *Bomarea* and *Alstroemeria* should be more frequently encountered as cultivated ornamentals. Both have showy flowers and foliage which is sufficiently attractive that the plants are decorative even when not in flower.

Fig. 20. **Bomarea rosea** as grown at Fairchild Tropical Garden, Miami, Florida. Photo by Dr. William D. Bell.

The foliage is not only of interest for display purposes, but may be unique botanically. We observe in the study of leaf stomata that most plants have pores or stomates on both the upper (adaxial) and lower (abaxial) leaf surfaces. In most cases, usually a higher count of stomates can be found on the lower surface than the upper. A much smaller group, including citrus, have stomates only on the lower or abaxial surfaces. We then are told that the striking exception to the rule is the water lily (example: *Nymphaea*) where the stomates are found only on the upper or adaxial surfaces.

Observe the leaves of either *Bomarea* or *Alstroemeria* carefully. When the stems are upright, one finds a 180° twist in the petiole of each leaf. Thus, what is developmentally the adaxial surface, that formed closest to the stem axis, becomes the lower leaf surface. In terms of leaf morphology, however, it remains equivalent to the upper surface of other leaves. The twist in the petiole results in this adaxial surface being functionally the lower surface.

Next, check for the presence of stomates (Bell and Stiles, PLANT LIFE, 1974). Leaf impressions of either genus show a surprising pattern of epidermal cells fitted together in delightful jigsaw configurations. Anyone with access to a microscope should be pleasantly surprised trying leaf impressions of these plants. Moreover, I found stomates only on the lower surfaces. Considering the 180° twist in the petioles, the stomates are located on what is developmentally the adaxial surface! These alstroemerids rank with *Nymphaea* as exceptions to a rule.

For 2 years, I had attempted to grow *Bomarea rosea* as a pot plant providing conditions under which my collection of amaryllids thrived. Only one of several potted bomareas had even survived by the time I moved from Gainesville to the Miami area. At Fairchild Tropical Garden, Mrs. Charmian Brooks, greenhouse manager, accepted the challenge to grow this plant which had never been grown at the Garden. Transferred to a tree fern basket with a light potting mix containing sphagnum and watered daily, a small plant in fair condition became a specimen plant within a matter of 4 or 5 months (Fig. 20). Cultural conditions for ferns, gesneriads or begonias in hanging baskets seem well suited for *Bomarea rosea*. Renewed interest in the use of baskets for plant culture should suggest to others that they try this and perhaps other species of *Bomarea*.

One further point to note is that this method of culture allows some stems to trail from the culture container. Leaves on such stems seem to have a tendency to reorient themselves. Perhaps the alstroemerids should also be given more attention in investigations of the geotropic responses of plants.

PLANT LIFE LIBRARY

CHEMOTAXONOMIE DER PFLANZEN, by R. Hegnauer. Vol. 6. Dicotyledoneae: Rafflesiaceae—Zygophyllaceae. Birkhauser Verlag, P. O. Box 34, OH—4010, Basel, Switzerland. pp. 882. Illus. 1973. Swiss francs 178.— Volumes 1 through 5 have been reviewed in previous issues of PLANT LIFE. This 6th volume lives up to the high standard of the previous volumes in this important series and is concerned with the 60 families of **Dicotyledoneae** from **Rafflesiaceae** through **Zygophyaceae,** which are considered in detail with reference to systematic arrangement of the plant groups on the basis of anatomical characteristics and chemical composition. The copious and indispensable literature citations appear in the text following the subject matter discussed. Information which has become available since the publication of vols. 1—5 is included in a supplement. A comprehensive index completes the volume. This important book is a mine of information for the plant taxonomist and cannot be too highly recommended.

CHEMOTAXONOMY OF FLOWERING PLANTS, by R. Darnley Gibbs. 4 Vols. McGill-Queens' University Press, 1020 Pine Av., West, Montreal, Canada. 1974. pp. xx + 2372. Illus. $135.00 (set of 4 vols.). We are privileged to bring to our readers' attention another valuable text on chemotaxonomy. The first part of the work (pp. 1—80) is concerned with a brief history of chemotaxonomy, the restriction of distribution of chemical constituents to plant categories, and parts of plants, chemical evolution, and rapid tests used by the author, and some results given in Tables 1 and 2. The second part (pp. 83-873) is concerned with the various plant constituents which are arranged alphabetically from **acetylenic compounds** to **waxes,** and the listing under named compounds of the occurrence in the various plant families and species. This information alone is worth more than the price of the whole work for nowhere else can he find such a summary! In compiling his section on the Families of Flowering Plants (pp. 880—1162), the author in search of relationships begins with Linnaeus and following workers up to the present time. The mountain of detail, mainly of historical interest, obscures the actual **families** recognized today. Fortunately, in the section on **Orders** of Flowering Plants (pp. 1165—1980), he has followed Engler (12th Syllabus ed. by Melchoir, 1954) with marked increase in clarity. He discusses the comparative chemistry of the **Families** under the **Orders.** The author's conclusions are based on the evidence presented in tabular form. Volume IV. is devoted to the very valuable **Bibliography** and **Index (pp. 1983—2302)** and an **Addendum** (pp. 2303—2372). These valuable contributions will be greatly appreciated by all workers in the field of chemotaxonomy, and the set is recommended to all interested in plant taxonomy.

PHYTOCHEMICAL METHODS, by J. B. Harbone. John Wiley & Sons (Halsted Press), 605 3rd Av., New York 10016. 1974. Pp. i + 278. $15.50 Subtitled, **A Guide to Modern Techniques of Plant Analysis,** this important new book has been writen as a "simple guide to modern methods of plant analysis for students in the plant sciences and which should also be of value to those interested in biochemistry, pharmacognosy, food science and 'natural products' organic chemistry." The seven chapters are devoted to methods of plant analysis; phenolic compounds; terpenoids; organic acids, lipids and related compounds; nitrogen compounds; sugars and their derivatives; and macromolucules. Highly recommended to those working in plant physiology, plant pathology, plant ecology, paleobotany, plant genetics, and plant systematics.

FUNDAMENTALS OF NUCLEAR SCIENCE, by P. N. Tiwari. John Wiley & Sons (Halsted Press), 605 3rd Av., New York. 10016. 1974. Pp. xi + 167. Illus. $7.95. Subtitled **With Applications in Agriculture and Biology,** this concise text will be welcomed. Part I. is devoted to basic nuclear science—the atom, nucleus, radioactivity, interaction of nuclear radiation with matter, nuclear radiation detection and measurement, and radiation protection. Part II is concerned with applications of nuclear science in agriculture and biology. Highly recommended to workers in agriculture and biology.

TRANSPORT OF NUTRIENTS IN PLANTS, by A. J. Peel. John Wiley & Sons (Halsted Press) 605 3rd Av., New York City 10016. 1974. Pp. (iv) + 258. Illus. $15.00. Dr. Peel presents a balanced, up-dated account of developments in the field of long distance transport physiology. The first four chapters are concerned with cellular pathways of transport, and the chemical solutes which are moved in the xylem and phloem. The following seven chapters deal with the nature of phloem transport and the ultrastructure of sieve elements, particularly the control of movement, solute-loading and unloading mechanisms, etc., and the movement of endogenous growth regulations and hormone directed transport. Highly recommended to advanced undergraduates and research workers in plant physiology, horticulture and agriculture.

STRUCTURE AND FUNCTION OF PLANT CELLS IN SALINE HABITATS, translated from the Russian by A. Mercado, edited by B. Gollek. John Wiley & Sons (Halsted Press) 605 3rd Av., New York City 10016. 1973. Pp. vi + 284. Illus. $30.00. The present work is concerned particularly with the changes in the function and structure of plant cells in saline habitats in the hope that this approach might help to clarify the mechanisms by which salt affects the plant and thus help to reveal the nature of salt tolerance. The chapters deal with salt tolerance in isolated tissues and cells, effect of NaC1 and dextran on nitrogen and carbohydrate metabolism, plastidal and soluble pigments, metabolism of organic acids, conversion of sulfur, nucleic acid and protein metabolism, subcellular structures, intermediate products of nitrogen metabolism, and chemistry of necroses. Highly recommended to plant physiologists, agriculturists, horticulturists, particularly those concerned with growth of crops on saline soils.

THE PHYSICAL BIOLOGY OF PLANT CELL WALLS, by R. D. Preston. John Wiley & Sons (Halsted Press) 605 3rd Av., New York City 10016. 1974. Pp. xiv + 491. Illus. $35.00. The author presents a comprehensive and up-to-date account of the present day knowledge of the physical biology of plant cell walls. Beginning with an outline of the types of molecular bonding in an array of polysaccharides, proteins and lipids which form the cell wall, the author continues with accounts of the physical and chemical methods used in investigating cell wall structure; the detailed architecture of algal cell walls; a contrasting account of higher plant cell wall structure; physical properties of plant cell walls; the primary cell wall and the impact of its structure on cell and plant growth; and biosynthesis of cell wall materials. Highly recommended to plant scientists, biochemists, biophysicists, and those confronted with biological problems in the timber, paper and food industries.

QUATERNARY PLANT ECOLOGY, edited by H. J. B. Birks and R. G. West. John Wiley & Sons (Halsted Press) 605 3rd Av., New York City 10016. 1974. Pp. x + 326. Illus. $44.50. Based on papers presented in a symposium at the Brit. Ecological Society, Univ. of Cambridge, 1972, which are designed to discuss and assess various approaches in the field of quaternary plant ecology, particularly methodological problems: pollen dispersal and sedimentation; pollen representation; plant macrofossil assemblages; vegetational and community development; limnological history. A summary—an ecologists viewpoint—and author and subject indices complete the volume. Highly recommended to ecologists, geologists, archae-

ologists, and paleobotanists.

PLANTS AND ENVIRONMENT, 3rd Edition, by R. F. Daubenmire. John Wiley & Sons, 605 3rd Av., New York City 10016. 1974. Pp. vii + 422. Illus. Subtitled **A Textbook on Plant Autecology,** this 3rd edition of an outstanding text will be welcomed. Autecology is the study of the interrelations between the individual organism and its environment. The author first discusses the various factors—soil, water, temperature, light, atmospheric, biotic (other plants and animals), and fire—singly as they interact with the plant. Next he considers the **environmental complex**—the multiplicity of interacting factors and the complexity of plant requirements; and finally, the end result, **ecologic adaptation** which shapes the course of **biologic evolution.** Highly recommended to all biologists, particularly plant biologists, horticulturists and agriculturists.

PLANTS: A SCANNING ELECTRON MICROSCOPE SURVEY, by J. H. Troughton and F. B. Sampson. John Wiley & Sons, 605 3rd Av., New York City 10016. 1973. Pp. x + 158. Illus. The invention of the electron microscope has made it possible to view three-dimensional aspects of plant structure at high magnifications. This new tool has stimulated research in biology revealing heretofore unseen aspects of plant structure. The authors present a fascinating selection of scanning electron microscope photographic reproductions covering procaryotic and eucaryotic plants or plant parts in this new perspective. The 163 plates show the shape and surface details of bacteria, diatoms and vegetative and reproductive features in fungi, lichens, seaweeds, mosses, psilophytes, lycopods, horsetails, ferns and conifers. In the plates devoted to the flowering plants, pollen structure, cell types, stems, root and leaf structure, seed and fruit are revealed. A valuable bibliography and index complete the volume. This outstanding book is recommended as a stimulating supplement to introductory courses in biology from high schools, to colleges and universities. It should also prove attractive to art students and general readers. This excellent book cannot be too highly recommended.

PLANT PHYSIOLOGY, 5th edition, by Merion Thomas, S. L. Ransom & J. A. Richardson. Longmans, Inc., 72 5th Av., New York City 10011. 1973. Pp. xv + 1062. Illus. $23.50. This 5th edition of an outstanding text will be welcomed. It is designed for undergraduate students, covering plant physiology and metabolism. Part I is devoted to the cell as a whole; in Part II the enzymatic partial reactions of metabolism are considered; Part III deals with absorption, translocation and elimination of water solutes and gases; Part IV is concerned with nutrition and metabolism; and Part V is devoted to growth, growth substances, and the effects of light and temperature on plant development and movements. Appendices I through III give background information on the chemistry of plant products, some relevant physical chemistry and notes on chemical and physical techniques. Appendix IV provides a comprehensive bibliography, and indices of authors and subjects. Highly recommended.

SOIL CONDITIONS AND PLANT GROWTH, 10th Edition, by E. Walter Russell. Longmans, Inc., 72 5th Av., New York City 10011. 1974. Pp. xviii + 849. $23.50. This 10th edition of an outstanding text will be welcomed because it incorporates the new contributions in this field since 1961 necessitating the complete or extensive rewriting of nearly all of the chapters. A new chapter on water-logged soils, and the effect of soil conditions on the growth of padi rice has been added. Otherwise, the same topics are discussed as in the 9th edition. However, some of the material has been rearranged. This excellent text is very highly recommended to students and research workers in soil science, and plant physiology, and workers in the fields of agriculture and horticulture.

PLANT LIFE LIBRARY—continued on page v.

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For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

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[AMERICAN AMARYLLIS SOCIETY, continued from page 2.]

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1. AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Traub & Moldenke (including the genera Amaryllis, Lycoris, Worsleya, Lepidopharynx, Placea, Griffinia, and Ungernia; Manila covers; 194 pages, incl. 18 illustrations. $5.00 postpaid.

This is required reading for every amaryllid enthusiast.

2. DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893—1948, by Norton, Stuntz, and Ballard. A total of 2695 Hemerocallis clones are included and also an interesting foreword, and explanatory section about naming daylilies. Manila covers; 100 pages (1—X; 1—90), includes a portrait of George Yeld. $5.00 postpaid.

3. THE GENERA OF AMARYLLIDACEAE, by Hamilton P. Traub. Includes a general introduction, a key to the subfamilies, infrafamilies, tribes, subtribes and genera of the Amaryllidaceae, and descriptions of all the genera. Every member of the Society should have this book for constant reference. Manila covers; publ. 1963; 85 pages. $7.00 postpaid.

4. LINEAGICS, by Hamilton P. Traub. This is the first outline text for the undergraduate student on the grouping of organisms into lineages. The text is divided into four parts: (a) the history of lineagics and lineagics as an integrated science; (b) basic lineagics, principles and procedures; (c) applied lineagics, principles and procedures; and (d) research methods in lineagics. Recommended for the student in biology. Publ. 1964. Manila covers, 163 pages, incl. 8 illus. $7.00 postpaid.

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PLANT LIFE

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1976

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The cover design, by Prof. Penrith B. Goff, represents the beautiful hybrid **Alstrosmeria** clone 'Walter Fleming'.

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4. AMARYLLID CULTURE

PLANT LIFE, VOLUME 32, NOS. 2—4, INCL., 1976
GENERAL EDITION

ILLUSTRATIONS

PLANT LIFE LIBRARY—continued from page 128.

PESTICIDES: AN AUTO-TUTORIAL APPROACH, by George W. Ware. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1975. Pp. i-xv + 191. Illus. $5.95.—This text deals not only with pesticides, but also with other uses of chemicals, and should be entitled, **PESTICIDES, GROWTH REGULATORS, DEFOLIANTS AND DESICCANTS.** It is described by the author as a self-instructional manual on pesticide application, for both private and commercial agricultural chemical fieldmen and structural pest control operators; and advanced high school students, college students, and others concerned with pesticides. The sections of the book are concerned with vocabulary and basic chemistry and formulations of **pesticides:**—insecticides; herbicides; fungicides; and bactericides; nematicides and rodenticides. In additon to the destructon of pests, chemicals are to be applied for other purposes: **plant growth regulators: defoliants;** and **desiccants.** Then follow sections on pesticides and the laws; safe handling and use of pesticides; and toxicity of pesticides. The book is completed with a final examination, glossary, bibliography and index. Very highly recommended to all working with pesticides, growth regulators, defoliants and desiccants.

GLIMPSES IN PLANT RESEARCH, VOL. TWO: STUDIES IN PLANT BIOLOGY—A PALYNOLOGICAL APPROACH, by P. K. K. Nair. Vikas Publishing House. Delhi. 1974. Imported by International Scholarly Book Services, P. O. Box 4347, Portland, Oregon 97208. This volume contains seven stimulating research papers by Dr. P. K. K. Nair of the National Botanic Gardens, Lucknow, who is an authority on palnology in relation to the evolution of plants. Five of the papers are on the subject of palnology, and two about plant morphology and evolution. The text is amply illustrated with line drawings, and in addition, photomicrographs of prepared pollen grains are presented in 12 plates, including a total of 86 figures to illustrate the article on Indian vegetable crops. This volume is highly recommended to all interested in palnology and evolution theory.

PLANT PHYSIOLOGY, by Dieter Hess. Springer-Verlag New York, Inc., 175 5th Av., New York. 1975. Pp. xiv + 333. Illus. Paperback $14.80.—Subtitled, **"Molecular, biochemical, and physiological fundamentals of metabolism and development"**, this forward-looking text "attempts to provide an introduction to the metabolic and developmental physiology of higher plants from a molecular biological point of view." The chapters are devoted to control of character formation by nucleic acids; photosynthesis; carbohydrates; biological oxidation; fats; terpenoids; phenols; amino acids; porphyrins; cell division, differentiation; gene activity as principle of differentiation; regulation; polarity and unequal cell division as fundamental of differentiation; cell elongation; the formation of seeds and fruits; germination; the vascular system and flower formation. Very highly recommended first of all to beginners in the study of plant physiology, but more advanced students can benefit from the message conveyed.

POLLEN, by R. G. Stanley and H. F. Linskens. Springer-Verlag New York, Inc., 175 5th Av., New York 10010. 1974. Pp. 307. Illus. $24.60.—Subtitled, **"BIOLOGY, BIOCHEMISTRY AND MANAGEMENT"**, this attractive text focuses upon pollen biology and chemistry and attempts to integrate these facts with management practices involved in pollen applications. The biological considerations are taken up in the **first section: Biology of Pollen.** —development, wall formation, dehiscence, size and distribution. The second section is concerned with **Management of Pollen.** —collection and uses; storage; viability tests; and nutritive role. The **biochemistry of pollen** is taken up in the third section,—general chemistry; carbohydrate and cell walls; organic acids; amino acids and proteins; pollinosis; nucleic acids; enzymes and cofactors; pollen pigments; and growth regulators. Very highly recommended to all interested in the biology and chemistry of pollens.

TROPICAL ECOLOGICAL SYSTEMS: TRENDS IN TERRESTIAL AND AQUATIC RESEARCH (Vol. 11. Ecological Studies), edited by Frank B. Golley and Ernesto Medina. Sprnger-Verlag New York, Inc., 175 5th Ave., New York 10010. 1975. Pp. xiii + 398. Illus. $24.80.—This volume contains contributions from various authorities who presented papers at the meeting on **tropical ecology** at New Delhi, India in 1971. The topics covered include physiological ecology; dynamics of populations; interaction between species; tropical forest analyses; savannas; tropical water bodies; island ecosystem; and applications. An index completes the volume. Very highly recommended to all interested in tropical ecology.

EPIDEMICS OF PLANT DISEASES: MATHEMATICAL ANALYSES AND MODELING (Ecological studies Vol. 13), edited by Juergen Kranz. Springer-Verlag New York, Inc., 175 5th Ave., New York 10010. 1974. Pp. x + 170. Illus. $24.60.—In the introduction the editor, Dr. Kranz, points out that the objective of our study of epidemiology is to provide plant pathologists with refined and deepened knowledge of the behavior of diseases in the field. In the text that follows, he assesses the role and scope of mathematical analyses and model-making in epidemiology. Dr. Mogk discusses automatic data processing in the study of epidemics; Drs. Butt and Royle explain multiple regression analyses in the epidemiology of plant diseases; Drs. Jowett, Browning and Haning report on non-linear disease progress curves, and Dr. Waggoner discusses simulated epidemics. There are references following each of the contributions. A subject index completes the volume. Very hghly recommended to all interested in plant diseases.

PLANT MINERAL NUTRITION, by E. J. Hewitt and T. A. Smith. John Wiley & Sons, 605 3rd Av., New York 10016, 1974. Pp. 298. Illus.—This outstanding new text on mineral nutrition in plants will be welcomed. After considering the historys and principles of plant nutrition, and experimental methods for the investigation of plant nutrient requirements, the various aspects of subject are discussed in detail: mineral absorption in plants; soil problems and diagnostic aspects of mineral nutrition; the effects of mineral nutrients on growth and plant composition; inorganic nitrgoen metabolism; and the functions and metabolism of the elements. An index completes the volume. This refreshing new outlook on the subject of plant mineral nutrition is to be commended. Very highly recommended to all interested in plant mineral nutrition.

ION TRANSPORT AND CELL STRUCTURE IN PLANTS, by David Clarkson. Halstead Press, a Division of John Wiley & Sons, 605 3rd Av., New York 10016. 1974. Pp. xi + 350. Illus. $22.50.—This refreshing new text introduces the undergraduate student and other interested persons to the fundamentals of mineral nutrition. The book is in two parts. The first six chapters are devoted to the principles of mineral nutrition at the cellular level, drawing on a range of plant and animal biology, but as each new principle or experimental measurement is introduced, it is referred to the alga, **Hydrodictyon africanum**, which is used as a test case and model system. The second part (five chapters) is devoted to higher plants, particularly with ion transport by plant roots. Thus the level of inquiry moves from single cells through whole organs, and complete plants. Author and subject indices complete the volume. Very highly recommended to all interested in plant nutrition.

PLANT LIFE LIBRARY—continued on page 10.

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AMARYLLIS
YEAR BOOK
1976

Year Book of

The American Amaryllis Society

43rd Issue

GENERAL AMARYLLID EDITION

EDITED BY

HAMILTON P. TRAUB

THOMAS W. WHITAKER

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY
Box 150, La Jolla, California 92038

THE AMERICAN PLANT LIFE SOCIETY

For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

I. THE AMERICAN AMARYLLIS SOCIETY

A Committee of the American Plant Life Society

DR. THOMAS W. WHITAKER, Executive Secretary

Box 150, La Jolla, Calif. 92038

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The Amaryllis Society of Baton Rouge, Louisiana, Dr. Joseph K. Mertzweiller, 9266 N. Parkview Dr., Baton Rouge, La. 70815.

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(AMERICAN AMARYLLIS SOCIETY, continued on page 129.)

PREFACE

The beautiful cover design by Prof. Penrith B. Goff, pictures the *Alstroemeria* hybrid, 'Walter Fleming' which again brings to our attention the fact that these wonderful plants with cut-flower possibilities are still being neglected in spite of the fact that the writer and others, particularly the late Harry L. Stinson, have attempted to arouse interest in them since 1934. The flowers are outstandingly beautiful and very long lasting as cut flowers, and sooner or later these facts will be appreciated. Our new Chairman of the Alstroemeria Committee, Mr. Donald D. Duncan, proposes to do all in his power to change the outlook on the Alstroemerias.

This 43rd issue of the AMARYLLIS YEAR BOOK is dedicated to Mr. Floor Barnhoorn, of Maraisburg, Transvaal, Republic of South Africa, who has been engaged in the plant nursery business since childhood in the Netherlands, where his particular hobby had been the breeding of Hybrid *Amaryllis*. After World War II, in 1948, he emigrated to South Africa, and as a co-founder of the Harry Deleeuw Co., Ltd., nursery firm, he again made hybrid *Amaryllis* breeding his particular interest. Through the years since 1948, he developed the outstanding "Hadeco" *Amaryllis* hybrids which are marketed world-wide in the wholesale trade, and are appreciated by the numerous *Amaryllis* enthusiasts who buy the bulbs over the counter from the local plant dealers. Mr. Barnhoorn contributes an interesting autobiography to the present issue, and one of his sons, Mr. F. Barnhoorn, Jr., details the method of *Amaryllis* breeding followed by his father, and his sons.

There are other articles on *Amaryllis* in the present edition. Mr. Doran, Chairman of the Amaryllis Committee, contributes an article on interesting new *Amaryllis* species and their hybrids. Dr. Flory and his associates, present papers on *Amaryllis caupolicanensis* and *Amaryllis belladonna* L. Dr. Cage, describes his *code system* for plant breeders which should appeal to the other plant breeders. Mr. Rogers, Vice-Pres. Northwest Region, explains his program for breeding fragrant *Amaryllis*. Mr. Blossfeld in Brasil, who is busy writing his two-volume work on the *Gardening in Brasil*, took time out to write on *Amaryllis calyptrata*. Dr. Whitaker, your Secretary, gives a survey on potting mixtures for Amaryllids; and Dr. Cage supplies instructions to make *Amaryllis* culture easy. Mr. Robers writes about his experiments with the storage of *Amaryllis* seeds.

There are various articles on other Amaryllids. Drs. Flory and Flagg write about the origin of three Texas *Zephyranthes* species. Dr. Howard reports on his *Zephyranthes* breeding project. Mrs. Wilson, Chairman of the Zephyrantheae Committee, presents a most interesing report. Mr. Bennett favors us with a brief report on *Clivia* breeding. Dr. Flory and his associates report on *Zephyranthes bifolia*. Mr. Buck, Chairman of the Hemerocallis Committee, reports for the years 1974 and 1975. Mr. Duncan, Chairman of the Alstroemeria Committee, presents his first report on successful *Alstroemeria* culture. Mr. Hannibal

writes about *Crinum* breeding.

In the General Plant Section, Dr. Zoellner and his student, contribute a report on *Miersia*. Mr. Hannibal gives a report on *Leucocrinum montanum*.

There are other contributions—on Amaryllis exhibitions in Texas, Louisiana, Alabama and California, and articles on other topics as shown by the Table of Contents.

Contributors to the 1977 issue of the AMARYLLIS YEAR BOOK are requested to send their articles by August 1, 1976, in order to insure earlier publication of this edition. Unless articles are received on time, publication will again be delayed to June or July or even later as with some issues in the past. Your cooperation toward earlier publication will be greatly appreciated. *Those having color slides or transparencies which they wish to use as the basis of illustrations are requested to have black-and-white prints made, and to submit these with their articles.*

December 15, 1975,
2678 Prestwick Court,
La Jolla, California 92037

Hamilton P. Traub
Thomas W. Whitaker
Harold N. Moldenke

PLANT LIFE LIBRARY—continued from page [6].

PLANT ANATOMY, by Forrest F. Stevenson and Thomas R. Mertens. John Wiley & Sons, 605 3rd Av., New York 10016. 1976. Pp. 1-xvii + 188. Illus. Paperback $4.95.—This **program** book of questions and answers deals with the anatomy of flowering plants. It begins with a discussion of the nature of **plant cells** and continues with the study of **primary and secondary plant tissues** which are components of **plant organs**—roots, stems, leaves and flower parts. This program book is "self contained and provides answers for all the questions which it asks." A selection of biology and botany textbooks is provided in which the answers to the questions asked may be conveniently found. This novel method of self-education is worthy of consideration, and is recommended to all students in plant anatomy.

AIMS AND METHODS OF VEGETATION ECOLOGY, by Dieter Mueller-Dombois and Heinz Ellenberg. John Wiley & Sons, 605 3rd Av., New York 10016. 1974. Pp. xi + 547. Illus.—This outstanding new text should set a landmark for its authors aim to reconcile the objectives and methods of the American and European schools of vegetation ecology. In Part I (General), the objective is to present a general background for an insight into **Vegetation Ecology,** and to provide the background for an understanding of the current trends in vegetation ecology, plant community hypotheses, and also to explain sampling methods in vegetation ecology. In Part II (Vegetation Analysis in the Field), the aims and methods of American and European workers in vegetation ecology are synthesized. This book thus sets a landmark, and is very highly recommended to all interested in ecology.

ENVIRONMENT AND PLANT ECOLOGY, by John R. Etherington and W. Armstrong. John Wiley & Sons, 605 3rd Av., New York 10016. 1975. Pp. i-xii + 347. Illus.—This text is concerned with the relationship between environment and plant physiological functioning, and with attempts to analyze the integrated operation of the ecosystem in terms

PLANT LIFE LIBRARY—continued on page 26.

DEDICATED TO

FLOOR BARNHOORN

HERBERT MEDALIST—FLOOR BARNHOORN

FLOOR BARNHOORN

An autobiography

I was born at Noordwijk, Holland on 3rd October, 1911. Noordwijk is the hometown of the Barnhoorn family, where the name has been known since the 16th century. It is a seaside holiday town on the North Sea. Quite a few inhabitants were engaged in North Sea fishing. The Barnhoorns, however, were never a seagoing family, but always farmers and bulb growers. Noordwijk is about 4 miles from the famous "Keukenhof" at Lisse, the centre of the Bulb District.

My schooling began on 1st May, 1917, and ended on 30th April, 1924. In 1924 the family moved to Sassenheim, another Bulb District town, and times were such, that every ablebodied boy had to look for a living as early as possible. Although my parents would gladly have worked still harder, to enable me to become a teacher or a tradesman and thereby obtain greater security than they had, but I insisted on a career in flower bulbs. The work in the fields during the day was soon followed by evening classes, when I found out the hard way, that field work in winter was not something to look forward to for the rest of your life. I wanted something better.

After four years of work in the field and the sheds. I got "promoted" to office work and became assistant to the buyer. This appeared to be something that came naturally to me and when I was 18 I got an appointment as a full-fledged buyer. To enable me to sign valid contracts as a minor, I received special dispensation.

My career as a buyer lasted till 1932, interrupted by six months' training in the Army Medical Corps. The Great Depression brought an end to buying flower bulbs and I became engaged in the wholesale cut flower trade, an experience I have never regretted.

In 1935 I came back into the world of flower bulbs and till 1937 I travelled to England and the United States, selling bulbs.

In 1938 I started my own business as a commission agent in flower bulbs. My experience as a buyer came in handy and my business was an immediate success, but came to an abrupt end when the Second World War broke out and I was called to serve. After the collapse of the Dutch Army under the German onslaught in May 1940, I, like so many people in the bulb business had to muddle through. My marriage to Trijntje Buijs in 1942 and the birth of our first son in 1943, did not make it any easier to keep to my trade.

I added vegetable seeds, peas and beans to my dwinding trade in flower bulbs so as to be able to provide for my family. As the Germans, of course, wanted as many food crops grown in the occupied territories as possible, there was not much restriction on this kind of trade. The seeds were sold to farmers under contract. The evasion of "export" to Hitler's Reich was a sport in itself in those war days and my family never had to resort to tulip bulbs and sugar beets for food as so many others had to do.

After the war, I saw emigration to a Southern Hemisphere country as my best chance to start my own Bulb Farm. My choice fell on South Africa, the natural habitat of many bulbous plants.

As long as I have been engaged with flower bulbs, the growing and developing of *Amaryllis* has been my particular hobby and when I emigrated to South Africa I could make my hobby part—and an ever-growing part—of my business. This was in April, 1948.

In South Africa I started with three partners (two of them ''Sleeping'' partners). Mr. Harry Deleeuw took the administrative burden, while I was responsible for the nursery and the production planning, with Mr. Pieter Overvliet, who is at present my co-director, as assistant. Our Company was registered as Harry Deleeuw Company (Pty) Limited.

The first Amaryllis were imported from Holland in November, 1948, and that same year some wild growing *Amaryllis* were obtained in South Africa. According to Traub (Plant Life *17:* 55. 1961; *19:* 57. 1963) these have been named *Amaryllis* x *mostertii* Traub and appear to be hybrids between the American Belladonna, *Amaryllis belladonna* L. (syn.—*Hippeastrum equestre* Herb.), and another species of the subgenus Omphalissa, plus *Amaryllis reginae* L. (syn.—*Hippeastrum reginae* Herb.), species native to the West Indies and South America. These should not be confused with the Cape Belladonna, *Brunsvigia rosea* (Lam.) Hann. (syn.—*Amaryllis rosea* Lam.; *Amaryllis belladonna* Herb. non L.) which is native to South Africa. *Amaryllis* x *mostertii* Traub apparently was introduced into India, South Africa and other parts of Africa by early colonial officials and their families and settlers and escaped from cultivation into the wild. The feral South African form reported by Mr. Mostert was collected in the vicinity of Balfour, Transvaal, Republic of Africa.

The intention was to get hybrids that were at the same time free flowering, early flowering, fast multipliers and with a good resistance to virus. These had to be hybrids that could be cultivated vegetatively in large quantities and could be offered to the public at reasonable prices.

A mass-hybridization program was set up and each bulb with its offshoots kept separate from the start, so that the first flower immediately gave an idea of the value of the clone. In some colors the ideal was reached quickly, but in colors like pink, white and mahogany the results did not come so fast. By now, pink hybrids have been developed that are real break-throughs in that color. They are no longer actually white with some pink, but real pink in various shades.

Also in white a few clones have been developed and are sold in fair quantities. Good mahogany clones are coming on, but cannot be offered in large quantities yet.

Every clone is tried out for at least five years. Trial bulbs are grown in pots under circumstances imitating conditions in the Northern Hemisphere: so that their value as potplants may be judged. Trials are brought to flower in October/December and January and at present

also in March/April. Some bulbs are also tried out in the Northern Hemisphere itself and only when all trials have been satisfactory is the clone introduced into the market.

Fellow-growers in Holland made the remark, that the HADECO Amaryllis was the best advertisement they could wish for, because of its good and fast flowering properties in the season when Dutch grown Amaryllis are offered for sale; they stimulate the sale of the later flowering Dutch Amaryllis.

Production and sales of Amaryllis worldwide has been quadrupled in the past five years, so there seems to be some truth in the above remark. Anyway, the lauditory letters from buyers in some 15 countries show that HADECO Amaryllis give satisfaction. Harry Deleeuw Company can barely cope with the ever growing demand.

Amaryllis are grown on five different farms to spread labor as well as weather risks. To utilise the lands, sheds, temperature rooms and other equipment for Amaryllis only, would, of course, make the product far too expensive,—for the Amaryllis crop only, 100,000 bulb trays are needed, just as an example—many other products are grown to get full utilization of the facilities. Important crops are Tulips, Daffodils and Ranunculus, the latter developed in a HADECO strain, that has in its own right conquered as good a place in the international market as the HADECO Amaryllis and is next to it and practically equal in commercial importance.

Daffodils and Narcisses are another Barnhoorn hobby. Together with Tulips and Hyacinths temperature treatments for these bulbs have been developed that make it possible to have them in flower normally, even in the hottest parts of South Africa.

Mr. Harry Deleeuw, the last of the original partners, left the Company in 1961. In the meantime, my three sons, Floris (32), Daniel (29) and Andre (24) have entered the Board of Harry Deleeuw Company, taking an active part in further developments.

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OBITUARY—HARRY L. STINSON

[The following obituary notice appeared in a local Seattle, Washington newspaper on January 4, 1961.*]

Funeral services for Harry L. Stinson, 71, who taught 33 years in the Seattle Public Schools, will be at 1 o'clock tomorrow in the Washington Memorial Funeral Home. Cremation will follow.

Mr. Stinson died in a hospital, Monday, after a long illness. He taught manual training at Edison Technical School before his retire-

* Kindly furnished by Donald D. Duncan.

ment in the late 1940's. Earlier he taught at Cleveland and Broadway High Schools. He also taught in elementary and junior high schools here.

A native of Denver, Mr. Stinson spent part of his early life in the Walla Walla area. He was a Navy veteran of the First World War and a graduate of the University of Washington.

Survivors are his wife, *Marian*, at the home, 3723 S. 154th St.; a daughter, *Mrs. R. Walter Johnson*, Seattle; three brothers, *Elton*, of San Jose, Calif., *Earl*, of Dowd, Iowa, and *Joe Stinson*, Oakland, Calif.; a sister, *Mrs. Leanore Sanderson*, Pleasant Hills, Calif., and two grandchildren.

IN MEMORIAM—HARRY L. STINSON, 1890-1961

The other night it was my pleasure to spend an evening with the wife and the daughter of Harry L. Stinson. Mr. Stinson, who for years was the driving force behind the Alstroemeria section of the

Fig. 2. Harry L. Stinson in his **Alstroemeria** garden.

Amaryllis Society, died in January of 1961. Unfortunately I never had the opportunity to meet him but I had heard a great deal about him not only from people in the Seattle area but from as far away as England.

With a bit of luck I was able to discover that his daughter and family were living in Tacoma, Washington. I phoned her and introduced myself and explained that I would like very much to talk with her. Not only was she surprised that I had been able to locate her after all these years but she said she would be happy to meet and talk with me.

Several nights later I went to Mr. and Mrs. Johnston's home in Tacoma and was delighted to find that Mrs. Stinson, who is now living with her sister, was able to join us.

It was a most enjoyable evening. Many wonderful stories were told about the days when Mr. Stinson grew and sold his "Alstroms" and Mrs. Stinson, active in Garden Clubs and flower arranging, would make corsages of *Alstroemeria* blossoms for the ladies who came to visit, see, and buy the beautiful Alstroemerias. They had a few slides of the Alstroemerias, and some showing Mr. and Mrs. Stinson harvesting the flowers and tubers in the field.

After Mr. Stinson's death, most of his papers and translations were taken to the University of Washington library. I spent hours in the library and placed many phone calls trying to find his works. Everyone was most helpful but no one was able to find a trace of them. What a shame that all of his works were lost.

When the family moved from the house where Mr. Stinson had his garden of Alstroemerias, no attempt was made to move any of the plants, so they were all lost. It is unfortunate that there was no one at that time to carry on his work or save his collection of plants.—*Donald D. Duncan*

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IN MEMORIAM—SYDNEY PERCY-LANCASTER, 1886-1972

DR. PRAKASH NARAIN,
National Botanic Gardens, Lucknow, India

It is sad to inform the members of the American Plant Life Society that Sydney Percy-Lancaster, the noted horticulturist died May 9, 1972, at 1:30 a.m. at Delhi.

In 1971 he was hospitalized at Lucknow and then transferred to Dehradun and finally brought to New Delhi for treatment. The long illness of Mr. Percy-Lancaster at an advanced age led to many complications which weakened him very much. He remained in a coma for long time before he died.

It is worth recalling that after his retirement as Secretary of the Royal Agri-, Horticultural Society, Alipore, Calcutta, he spent a major period at the National Botanic Gardens, Lucknow. During this stay, he published several popular articles and bulletins on several aspects of gardening and hybridization techniques on various ornamental plants grown in present day gardens. He gave several broadcasts, lectures and popular talks to gardening clubs, schools and other institutions.

Aside from being a great horticulturist, Mr. Percy-Lancaster was also known as a poet, who composed a large number of poems, dedicated to his friends.

The sad demise of Mr. Percy-Lancaster has shocked all of us. We extend our condolences to his family, and pray God may provide rest to the departed soul.

EDITORIAL NOTE

Mr. Sydney Percy-Lancaster received the WILLIAM HERBERT MEDAL in 1939 for his important contributions toward the advancement of the amaryllids. The readers are referred to Herbertia, Vol. 6. 1939, pp. 40-43, with portrait, for a brief autobiography.

THE SYDNEY PERCY-LANCASTER MEMORIAL SOCIETY

DR. T. M. KHOSHOO, *Director,*
National Botanic Gardens, Lucknow, India

(Under date of July 21, 1975, Dr. T. N. Khoshoo sent the following tribute to the late Sydney Percy-Lancaster, born July 19, 1886, died May 9, 1972. He also sent a prospectus of the new Sydney Percy-Lancaster Memorial Society which will sponsor an annual lecture by an eminent Indian scientist in the field of ornamental horticulture at the National Botanic Gardens, Lucknow, and other activities connected with ornamental horticulture.—*Editor*)

(1) *The late Mr. S. Percy-Lancaster:* He was a personal friend

of mine and I had the honour to write about him in the Indian Horticulture [see following article.] He left NBG for some time to join Indian Botanic Garden, Calcutta, but he returned soon to Lucknow having shattered his health while at Calcutta. He had a paralytic stroke and passed away on May 9, 1972 at 1:30 A.M. at Delhi. He was cremated the same day and, as per his wishes, his ashes were sprinkled in our Garden (NBG). Between then and now, there were many changes here, and I was awaiting a suitable opportunity to organise a Sydney Percy-Lancaster Memorial Society. [This Society has now been organized.]

(2) Based on the collections that the late Mr. Percy-Lancaster made, I and my pupils [Drs. Iva Guha (nee I. Mukherjee), S. N. Raina, Prakash Narain and S. N. Zadoo] have worked on bulbous (using the word not in strict botanical sense) plants and accordingly we have studied *Canna, Zephyranthes, Crinum, Gloriosa, Amaryllis, Hemerocallis,* etc. and so far four Ph.Ds. have been granted and a number of papers published in national and international journals [136 articles].

(3) Having been inspired by the work of the late Mr. S. Percy-Lancaster, I thought I could complete the picture from the genetical angle. That this work has been done, and our laboratory is known all over for these studies, has been my way of paying homage to my friend, the late Percy-Lancaster.

PERCY-LANCASTERS: DOYENS IN INDIAN HORTICULTURE *

T. N. KHOSHOO, *Director, National Botanic Gardens, Lucknow*

Three generations of gardeners bearing this name, have served Indian horticulture over a period of about three-quarter of a century. They worked incessently and with ability having left a name in the history of horticulture. The first was Mr. Percy Joseph Lancaster, a banker, whose hobby was gardening. He came to Lucknow in 1889. The Superintendent of the Horticultural Garden, was his friend of many years' standing and Mr. Lancaster would pay frequent visits to him to learn more about gardening. He was particularly interested in crossbreeding *Canna* and *Amaryllis,* of which he had to his credit a number of varieties popular in the nineties. In 1892, Mr. Lancaster moved to Calcutta as the Secretary of the Agricultural and Horticultural Society of India. He maintained his interest there in hybridization work, and in 1902 he crossed *Cooperia* and *Zephyranthes.* The resulting hybrids were however lost at the time of his death in 1904.

Mr. Lancaster during his secretaryship introduced many useful plants from Europe, the Far East, and South America. He wrote a number of articles most of which were published in the Journal and Proceedings of the Society. His wife, Mrs. Ida Gordon Lancaster, was an amateur painter and her paintings of plants are housed in the National Botanic Gardens.

* **Reprinted from Indian Horticulutre, April-June 1966.**

Lancasters first son, Sydney, representing the second generation of gardeners was born on July 19, 1886 at Meerut. His maternal grandfather conducted an aptitude test, when the baby could just sit up. He spread before the boy different articles, each symbolising a profession. Unmindful of their representational value young Sydney picked up the *Khurpi*. This indicated the boy's taste for gardening. He made a *Canna* hybrid when he was just eleven years old. In 1902 he was apprenticed to the Agricultural and Horticultural Society and on his father's death in 1904, he was appointed an Assistant. In 1910 he became an Assistant Secretary and then the Secretary in 1914 till his retirement in October, 1953, after a long service to the society and to the Indian horticulture as a whole.

In November, 1953, he joined the National Botanic Gardens as Senior Technical Assistant because of his early life association with Sikandar Bagh. He wished to spend the remainder of his life at Lucknow where gardening traditions of his family began. He served National Botanic Gardens till January, 1959 when his son, Mr. Alick Percy-Lancaster pressed him to join the family at Salisbury (Southern Rhodesia). But after his wife's death in 1960 and Alick's death in 1961, he returned to the National Botanic Gardens in November 1961.

During the work of about half a century in Calcutta, Mr. Percy-Lancaster has introduced many new plants from abroad. He had particular fascination for hybridization work and many plants found nowadays in Indian gardens owe their origin to him. A complete list of the hybrids is catalogued in the records of the Royal Agri-Horticultural Society. In recognition of the service rendered by the Society, King George V permitted to prefix the word 'Royal' to the Society's name.

To mention a few of his creations, his zoned Cosmos called 'Alipore Beauty' renamed 'Radiance' by the famous American seedsman, Bodgers, has been distributed all over the world. There are many Cosmos variations in cultivation, the choicest being the 'Bicolor White Crest'. He has also developed a beautiful pyramidal headed Hollyhock from a presumed cross between *Althaea rosea* and *Malva sylvestris*. Repeating his father's cross between *Cooperia* and *Zephyranthes*, he obtained a large number of colour variations in the ensuing hybrids named *Cooperanthes*. These hybrids are far superior in colour and performance to either parent. *Cooperanthes* has now been merged in *Zephyranthes* proper. Besides these, he made a number of crosses at varietal and specific level in genera like, *Amaryllis, Barleria, Bauhinia, Begonia, Bouganvillea, Canna, Cassia, Chrysanthemum, Crinum, Hedychium, Hemerocallis, Hibiscus, Ixora, Lagerstroemia, Petunia, Poinsettia, Rosa, Tecoma* etc.

KEEN-EYED MAN

His keen eye never missed any worthwhile spontaneous mutation (somatic and otherwise). Mention may be made of the interesting mutants discovered in *Acalypha, Codiaeum, Hibiscus, Malvaviscus,*

Panax, Sansevieria etc.

In National Botanic Gardens, he got an opportunity of utilizing his knowledge in horticulture for public use. He helped to beautify many parts of the garden, in particular the conservatory with which he has an association as a boy. At present he is continuing his work on *Althaea, Amaryllis, Canna, Cosmos, Petunia* etc.

In recognition of his success with *Cooperanthes,* Prof. Hamilton P. Traub (Plant Life Society, USA) named in 1954 a horticultural genus x *Sydneya* after him. This genus is based on the hybrids from the cross *Zephyranthes* x *Habranthus.* In horticulture several 'species' and 'varieties' arising from hybridization or as mutations are named after Lancaster. To quote a few of the important ones, *Acalypha lancasteri, Antignon lancasteri, Bougainvillea* 'Alick Lancaster', B. 'Enid Lancaster', B. 'Mrs. Lancaster', *Cassia* x *lancasteri, Crinum lancasteri, Hibiscus* 'Percy-Lancaster', *Panax lancasteri, Sansevieria trifasciata lancasteri, Zephyranthes lancasteri* etc.

A TALENTED AUTHOR

Mr. Percy-Lancaster, is a talented author of the gardening manual, 'An Amateur in an Indian Garden,' published in 1929, and shortly appearing in its enlarged third edition. For over 60 years he has written several hundred articles on various aspects of gardening and garden plants as a Gardening Correspondent to several Indian newspapers, monthly magazines, and foreign journals. He edited the material of the Royal Agri-Horticultural Society from 1904 to 1920, when this publication ceased. Thereafter Annual Reports of the Society carried items of interest and short articles by him. He was also the author from 1935 to 1953 of the monthly 'Garden News Sheet' which was regularly published except for about two years during World War II.

He has written 55 bulletins published by the National Botanic Gardens. This collection ranges from detailed accounts on ornamental plants to plant breeding simplified, sacred plants of Hindus, garden lay out, etc. He gave several broadcasts, lectures, and popular talks to gardening clubs, schools and institutions. A fact may not be known to his friends that he composed a large collection of poems.

As a garden planner, he has helped a large number of amateurs not only in Calcutta but in several other Indian cities. He is in constant demand as judge at flower shows.

He was elected to the Linnean Society of London in 1920. At present he is Secretary of the Garden Lovers Society, Lucknow, and has helped to organize flower shows.

The Amaryllis Society of America awarded him the 'Herbert Medal' in 1939 for "his eminent services in cross-breeding." The Royal Agri-Horticultural Society of India awarded him the 'Carey Memorial Gold Medal' in 1962 for his long service to horticulture.

The third generation of garderners in this family was represented by Mr. Alick Percy-Lancaster, the younger twin son of Mr. S. Percy-

Lancaster. Born on July 21, 1912, Alick showed a great love for plants during childhood. In 1930 he joined as an apprentice at the Royal-Agri-Horticultural Society getting training for a year from his father. He proceeded to the Royal Botanic Gardens, Edinburgh for training for three years, and thereafter to Kew for further training. On his return to India, he was appointed Superintendent of gardens of the Governor's estate in Bengal. Subsequently, he joined as Assistant Superintendent, Horticultural Division, Central Public Works Department, New Delhi where he was in-charge of parks and public gardens of New Delhi. He rose to be the Superintendent, and later was the first Director of Horticulture, CPWD. In this position his advice on the horticultural side of town planning was sought by various States and he was associated with Chandigarh and Rourkela. Like his father, he too had the privilege of being a judge at flower shows and garden competitions.

Mr. Alick Percy-Lancaster was a prolific writer and contributed to a number of dailies and magazines. For three years he continued to publish 'Garden Chat', a monthly bulletin and remained a regular speaker at the AIR on gardening subjects.

He resigned in 1956 and left India to settle in Salisbury (Southern Rhodesia) where he passed away after a short illness in 1961.

The three generations of these famous gardeners are survived by Mr. Sydney Percy-Lancaster, who entered his eightieth year in July last [1965, deceased May 9, 1972]. He is actively interested in a number of plant species and is writing several bulletins. In fact the only link between him and the world is the heap of unfinished work. The lovers of horticulture can hardly forget him.

HERBERT MEDAL PRESENTATION

At The Los Angeles States and County Arboretum Arcadia, CA

A special event of the Eleventh Annual Show of the Southern California Hemerocallis and Amaryllis Society was the presentation of the Herbert Medal to Mr. John M. Cage. Mr. Cage earned this prestigious award for his outstanding research in the breeding and culture of *Amaryllis.*

Dr. Thomas W. Whitaker, Executive Secretary, The American Plant Life Society, presented the Medal to Mr. Cage on Sunday morning, April 27, 1975, in the Lecture Hall of the Arboretum, before Society members and visitors. Also present were his charming wife, Mrs. Mildred Cage, and previous Herbert Medal Award winners, Quinn Buck (1969), and Leonard Doran (1972). Dr. Ruppel of Argentina, an award winner in 1971, had planned to be present, but was delayed by transportation difficulties.

Dr. Whitaker commended Mr. Cage for his exciting discoveries in the breeding of *Amaryllis,* particularly for his development of techniques leading to the production of inbred breeding lines.

In his acceptance speech, Mr. Cage spoke of the joy and satisfaction

derived from creative work with this group of beautiful plants. He sketched briefly some of his accomplishments in the field of *Amaryllis* breeding, and outlined the interesting goals that lie ahead. Mr. Cage is evidently one of those few talented and remarkable individuals that

Fig. 3. Dr. John M. Cage, left, responding after receiving the 1975 HERBERT MEDAL from Dr. Thomas W. Whitaker, Society's Secretary, far right. Mrs. Cage in center. Photo by Phil Rosoff.

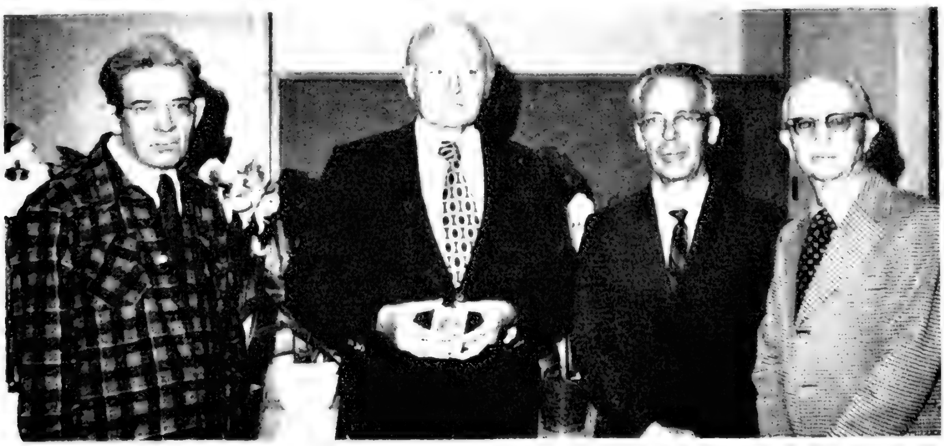

Fig. 4. Three HERBERT MEDALISTS present at the presentation ceremony, from left to right, W. Quinn Buck, 1969, Dr. John M. Cage, 1975 and John L. Doran, 1972. Dr. Thomas W. Whitaker, Society's Secretary, far right. Photo by Phil Rosoff.

have made notable contributions to both their vocation and their hobbies. Mr. Cage is a skilled electronics engineer (now retired), in addition to being one of the very best of our *Amaryllis* breeders. —*Thomas W. Whitaker*

DONALD D. DUNCAN, NEW CHAIRMAN OF THE ALSTROEMERIA COMMITTEE

We are happy to announce that at last we have a new Chairman of the Alstroemeria Committee, a post left vacant since the death of Harry L. Stinson in 1961.

Fig. 5. Donald D. Duncan in his Washington **Alstroemeria** plantation, 1975.

Mr. Duncan was born in Newberg, Oregon and is in his 44th year. He graduated from Oregon State University in Corvallis, with the degree in Floriculture. He served as an officer in the United States Air Force, and since leaving the Air Force has been active in floriculture, and in the florist trade. He has been interested in floriculture since he was 14 years old, and has been manager of a Florist shop in Seattle for the past ten years. It goes without saying that he is keenly interested in Alstroemerias and especially the breeding of these fine plants.

All who have species and hybrids of *Alstroemeria* should get in touch with him so that an inventory can be made of the species now in the United States.—*Hamilton P. Traub*

EDITOR'S MAIL BAG

On May 9, 1975, we greatly enjoyed a visit from Dr. Carlos A. Gomez Ruppel, of Argentina, Mr. C. D. Cothran and Mr. Sterling Harshbarger from the Los Angeles area. Dr. Ruppel and his wife have been on an extended visit to the United States, including the Miami, Florida area, the Houston, Texas area, and Brownsville in the Lower Rio Grande Valley of Texas .

Mr. Fred B. Jones, the 1961 WILLIAM HERBERT MEDALIST (see PLANT LIFE, Vol. 17. 1961) has published "Flora of the Texas Coastal Bend". He was honored at a reception at Corpus Christi (Texas) Museum, on February 16, 1975, sponsored by the Corpus Christi Museum and the Welder Wildlife Foundation.

We are saddened to announce that Mrs. Lydia C. Pahls, a native of New York who came to Miami, Dade County, Florida in 1926, died January 21, 1975. She was a member of the American Plant Life Society, Fairchild Tropical Garden, and South Florida Garden Club.

On October 3, 1975, we enjoyed a most interesting visit from Mr. Laurie Bell, a plant nurseryman, 186 Great North Road, Henderson, Auckland, New Zealand. Mr. Bell is on a trip to the United States, Europe and South Africa, and will contribute an article on what he saw to the 1977 PLANT LIFE.

We are saddened to report that William D. Morton, Jr., died on November 11, 1975 at his home in Pensacola, Florida. Mr. Morton received the WILLIAM HERBERT MEDAL in 1963 for re-establishing the registration of *Amaryllis* cultivar names after World War II. An autobiography with portrait of Mr. Morton appears in PLANT LIFE *19:* 6-9. 1963. At Christmas time in 1974, Mr. Morton sent greetings from his new home in Florida, stating that he intended to devote his time to *Amaryllis* growing.

Under date of November 22, 1975, Harry Blossfeld, Rua Pedro 360, Tremembe 02371, Sao Paulo, Brasil, writes that he is still working on his 2-volume book on *Gardening in Brasil*, and therefore has less time to correspond with his many friends abroad, and hopes that they will understand his silence.

PLANT LIFE LIBRARY—continued from page 10.

of the multiple interactions between environment and organisms. After explaining the aims and developments of plant ecology, the author discusses energy change and productivity; soils—chemical and physical properties in relation to the plant root; plants and water deficit with respect to physiological and ecological aspects; water-logged soils; mineral nutrition, and competition. A bibliography and index complete the volume. Highly recommended to all interested in ecology.

THE SHIKIMATE PATHWAY, by Edwin Haslam. John Wiley & Sons, 605 3rd Ave., New York 10016. 1974. Pp. (1-vii) + 316.—Shikimic acid was discovered nearly ninety years ago, but its biochemical significance was not realized until the 1950's when it was noted that it is an important intermediate in one of the major pathways of metabolism of aromatic compounds in nature. The chapters are concerned with the biosynthesis of aromatic amino acids; the chemistry of intermediates; metabolites of the shikimate pathway; metabolism of aromatic acids by micro-organisms and by higher plants; phenylpropanoid compounds and their derivatives, and miscellaneous metabolites, in higher plants. An index completes the volume. Highly recommended to all interested in the pathways of metabolism.

THE COMPLETE BOOK OF HOUSEPLANTS UNDER LIGHTS, by Charles Marden Fitch. Hawthorn Books, Inc., 260 Madison Av., New York 10016. 1975. Pp. 275. Illus. $9.95.—In this volume, the well-known horticulturist, Charles Marden Fitch, who has grown plants under lights for two decades, shares his accumulated knowledge about this method of gardening with gardeners generally. The book is in two sections. In the first he deals with the **basics of light gardening**, the different kinds of lamps and reflectors, and how to install them; where to use lights, the newest fixtures, carts, stands, the lastest research findings simplified and condensed for the practical gardener. Section 2 is devoted to the **growing of plants**—the culture of many species suitable for light gardening with recommendations for day- and night-length, proper distance between foliage and lights, and other guides to facilitate culture. Highly recommended to all gardeners.

NEW YORK TIMES **BOOK OF INDOOR AND OUTDOOR GARDENING QUESTIONS**, edited by Joan Lee Faust and Lisa Oldenburg. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York 10022. 1975. Pp. i-ix + 214. Illus. $7.95.—This book is in three sections. Under **Trade Secrets**, we learn that the book is the outgrowth of the **New York Times** Garden page question and answer column. Thus, the distilled knowledge from this source has provided the material for the book. The second section is devoted to the answers concerning **indoor and city gardening**, particularly plants in pots, on the terrace, ground floor and high rise. The third section is concerned with **outdoor gardening**—nature's helpers and hinderers; compost, mulching; lawn tips; ground cover care; herbaceous plants, vines, shrubs and trees; edibles, cooking, curing, drying, storage and many other hints. Highly recommended to all gardeners.

LOW MAINTENANCE PERENNIALS, By Robert S. Hebb. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York 10022. An original paperback. Pp. 220. Illus. $4.95.—In the first section, the author explains that there are two groups of perennials—those requiring a great deal of pampering for survival, and those which may be less demanding, and which may also be less familiar to the gardener. It is the latter group which is treated in the present volume. The second section is devoted to recommended perennials of low maintenance; retail nursery

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1. REGIONAL ACTIVITY AND EXHIBITIONS

THE 1975 AMARYLLIS SHOW SEASON

The season began very early on March 8th and 9th with the *Coastal Bend Amaryllis Show* at Corpus Christi, Texas. The *Greater Houston Amaryllis Club* Show was held on April 6th. Two Amaryllis shows were staged on April 12th and 13th: The *Amaryllis Society of Mobile (Alabama)* Show and the *Houston Amaryllis Society* Show. The *Southern California Amaryllis Show* was held on April 26th and 27th. The show season ended with the *Spring Extravaganza* staged by the *Southern California Hemerocallis and Amaryllis Society.*

The *Alabama Amaryllis Society* Show was not held in 1975, but plans for the 1976 show are being made. The report of the *New Orleans Men's Amaryllis Club* show was received late and had to be placed at the end. No report was received from the *Baton Rouge Amaryllis Society.*

NOTE TO AMARYLLIS SHOW ORGANIZERS

It is important to designate some one to write a *brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub, Editor, Amaryllis Year Book, 2678 Prestwick Court, La Jolla, Calif. 92037. *Your plans are not complete until this appointment has been made.* Only in this way is a permanent international record of your show assured.

COASTAL BEND 1975 AMARYLLIS SHOW

MRS. CARL C. HENNY, *Corresp. Secy.,*
Coastal Bend Amaryllis Society, Box 3054,
Corpus Christi, Texas 78404

Our "Festival of Flowers" presented by the Corpus Christi Council of Garden Clubs was held here in our Coliseum on March 8th and 9th, of this year. We members of the Coastal Bend Amaryllis Society were a bit dubious in regard to having any specimens to enter in our Exhibit due to such an early date for the show. Much to our surprise we did have twenty four entries to be judged. Our weather for this winter has been very changeable with little rain and many cold, dry northers each week-end. However, we did have a week or so of unusual hot weather for this time of the year, which did help to bring out a number of Amaryllis scapes for bloom.

Among the Ludwig named and registered, Amaryllis entered were 'Candy Cane,' 'Gipsy Giant', 'Peppermint', 'Salmon Tower', 'Little Sweetheart', 'Melody Lane', 'Red Man' and 'Twinkling Star' of the Gracilis Type. Mr. E. P. Adams entered a cross between 'Apple Blossom' and 'United Nations', and a cross between 'Ludwig's Dazzler'

and 'Trixie'—in the Breeder's Class. Both scapes scored 90 points.

Mrs. Carl C. Henny received the Silver Bowl Award which took the place of the Ludwig Challenge Cup, for her entry of Ludwig's 'Candy Cane.' She also received a Special Trophy for the greatest number of blue ribbons awarded—for entries in the Breeders Class. Mrs. Henny was given an Award of Merit by the Council of Garden Clubs for her entry of a Ludwig Type Seedling which scored 97 points.

Mr. Duane C. Eckles was given the "Seal of Merit" for his entries of Gracilis 'Melody Lane' with a score of 90 points, and also 'Red Man' and 'Twinkling Star'—with both scoring 95 points, since he was not eligible for the Silver Bowl Award which cannot be won two years in succession.

Mr. Eckles also received the Award of Merit, given by the American Amaryllis Society for his entries of 'Red Man' and 'Twinkling Star', both scoring 95 points.

A Special Trophy was awarded a non-club-member, Mr. J. M. Mabe, for his entry of 'Peppermint' which scored 93 points.

Judges for our show were Mrs. Charles Sanders, Mrs. C. E. Weeks, and Mrs. Reid B. Cochran, all National Flower Show Judges. We were unable to get an accredited National Amaryllis Judge to help judge our show this year.

GREATER HOUSTON AMARYLLIS CLUB SHOW, 1975

MRS. SALLY FOX, *Corresponding Secretary*
1527 Castle Court, Houston, Texas 77006

"Amaryllis Announce Spring" presented a burst of color to visitors to the Houston Garden Center on April 6, 1975. The Staging Committee used bright yellow parasols adorned with ribbon tied amaryllis as the focal point, which was most attractive.

Amaryllis are very effective in arrangements and Mrs. G. D. Everett's committee added much beauty to our show. With varied complimentary material the arrangements were lovely.

Entries were judged by Accredited Amaryllis Judges and trophies were awarded to:—

Mrs. P. A. Froebel, a consistant winner who added three silver trophies to her winning list this year. She was presented the Ludwig Challenge Cup for an Outstanding 'White Favorite' along with the Greater Houston Amaryllis Club tray for a Van Meeuwen specimen 'Glorious Victory', and a covered silver dish for a Ludwig miniature 'Peppermint'. She received Awards of Merit from the American Amaryllis Society.

Mrs. G. D. Everett won a silver plate for an American Hybrid at its peak of beauty with six open florets. She was presented an Award of Merit.

Mrs. Robert Rucker, Jr., won a silver shell for her "Dutch Seedling", which was a solid deep orange of excellent form. She received a Preliminary Commendation from the American Amaryllis Society.

Mrs. John H. Ellett showed an outstanding 'Senorita' in the Species Class and was given a Rosette.

Mrs. Sally Fox, who acted as General Show Chairman, won the Warnasch silver tray for "Sweepstakes".

The show, with fewer specimens than previous shows due to an early Spring in February followed by late Winter in March, was outstanding since there were many "Other Amaryllids" displayed. The "Species" section had about a dozen and the visitors were fascinated with these very small perfect shaped *Amaryllis*.

Fig. 6. Greater Houston Amaryllis Club show, 1975, trophy winners, **left to right,** Mrs. Sally Fox, Mrs. G. D. Everett, Mrs. John H. Ellett, Mrs. P. A. Froebel and Mrs. Robert Rucker, Jr.

Mrs. A. O. Aschenbeck had an interesting "Educational Exhibit" which included beautiful plants of the sought-after Blue Amaryllis *Procera worsleya* Rayneri, the green *Amaryllis calyptrata* and the pale yellow *Amaryllis evansiae*.

Also, the display of "Dutch Seedlings" was an encouraging factor, proving much thought had gone into the program set up by these novice hybridizers.

In the Gulf Coast Area most of our *Amaryllis* are grown in the garden and the weather is a very important factor, so when we are able to have enough show quality specimens to exhibit we are happy to share them with the public—thereby promoting interest in growing *Amaryllis*.

1975 AMARYLLIS SOCIETY OF MOBILE SHOW

(MISS) MILDRED LAUGHLIN, *Publicity Chairman,*
701 Dauphin Isle Pkway, Mobile, Alabama 36606

President E. A. Wiggins announces winners of Trophies at the Twenty-Second Annual Greater Gulf Amaryllis Show, presented at the Bel Air Mall, April 12-13, 1975 by the Amaryllis Society of Mobile. The Trophies were presented on April 13, 4 p.m. by Huey Summers, Show Chairman and Master of Ceremonies. All trophies being retained for one year, unless otherwise stated.

Mrs. Lois Kountz was the winner of seven trophies which were as follows: the Most Blue Ribbons in show, including Horticultural. American National Bank & Trust Co. Trophy Silver Paul Revere Bowl. The Most Blue Ribbons in the Combined Dutch Hybrid, Potted & Cut Amaryllis Divisions. Swetman Amaryllis Garden Trophy Large Silver Tray with handles. The Most Outstanding Horticultural Potted Bulb Specimen of American Hybrid Amaryllis in Show. The John J. Mason Memorial Trophy. The Most Outstanding Horticultural Potted Bulb Specimen of African Hybrid Amaryllis in Show. T. J. Swetman Silver Trophy. The Most Blue Ribbons in the Combined American Hybrid Potted & Cut Amaryllis Divisions. The Inez Scheuermann Silver Trophy. Most Blue Ribbons in the Dutch Named Varieties. Amaryllis Society Trophy to be retained by first year winner. Most Blue Ribbons in the Unnamed Cut Seedlings. Amaryllis Society Trophy to be retained by first year winner.

C. E. Tagert was the winner of four trophies which were as follows: the Most Blue Ribbons in Horticultural Division: Joseph S. Norton Trophy, Silver chased tray with handles. The Most Blue Ribbons in the Dutch Hybrid Potted Amaryllis Division: Robert Hiram Swetman Memorial Trophy Silver Tray with handles. The Most Blue Ribbons in the Dutch Hybrid Cut Amaryllis Division. Wesley J. Marshall, Sr. Memorial Trophy Silver Tray with handles. Most Blue Ribbons in the Single Bloom Named Division. Amaryllis Society Trophy retained by first year winner.

Mrs. Nell Keown was the winner of three trophies which were as follows: Most Outstanding Horticultural Cut Specimen of Dutch Amaryllis in Show. Claude H. Moore Memorial Trophy. Most Blue Ribbons in the Unnamed Potted Seedlings. Amaryllis Society Trophy retained by first year winner. Most Blue Ribbons in the Single Bloom Unnamed Division. Amaryllis Society Trophy retained by first year winner.

John Clark was the winner of two trophies which were as follows: Most Outstanding Horticultural Potted Bulb Specimen of Dutch Amaryllis in Show. John A. Lamey Memorial Trophy. Best Ludwig Named Variety in the Show, cut or potted. The Ludwig Trophy which is a perpetual revolving trophy.

The following exhibitors each won one trophy: *Mrs. Velma Thompson* for the Most Outstanding Horticultural Cut Specimen of American

Hybrid Amaryllis in Show. Amaryllis Society Trophy retained by first year winner. *Mrs. Claudine Pierce* for the Best Potted Miniature. Amaryllis Society Trophy retained by first year winner. *Freddie Frambrough* for the Best Cut Miniature. Amaryllis Society Trophy retained by first year winner. *Mrs. N. K. Bunch* of Selma, Ala. for the Best American Hybrid Seedling (In Horticulture) Shown for first time. The Men's Garden Club of Mobile Certificate of Honor.

After the judging of the show, the judges were guests of the Amaryllis Society of Mobile at a luncheon.

Officers elected for the 1975-76 term of office are: President: John R. Clark; Vice-Pres: W. A. McCollum; Secretary: Mrs. Olga McCollum; Treasurer: Mrs. Lola Templin; Historian: Miss Carmen Romero.

1975 HOUSTON AMARYLLIS SOCIETY OFFICIAL SHOW

MRS. A. C. PICKARD, *Official Show Chairman,*
1909 Alta Vista, Alvin, Texas 77511

Our annual Amaryllis Spring Show was held April 12-13 at the Garden Center, Houston, Texas.

The Houston climate is very favorable to garden *Amaryllis* but there is always an uncertain blooming season for the selected show date. There were many anxious days preceding our show, wondering if we could be lucky to collect a selection of competitive blooms for the official divisions. As the final hours grew near, we surprisingly filled the tables with mostly cut specimens. There were sufficient entries of pot grown plants to receive the high awards and ribbons.

Award of Merit, the highest score for potted specimen in possession more than one year went to Ludwig's 'Marie Goretti'—exhibitor, Mrs. L. E. Morgan who also received the Amaryllis Society Award, silver pitcher.

Second high score for cut specimen, in possession more than one year was 'Ludwig's Dazzler', exhibitor—Mrs. J. L. Williams, receiving the Society's trophy, silver bowl.

Award for the best cut specimen in possession less than one year, was Van Meeuween's 'Parcifal', exhibitor Mrs. Troy Wright who also received the Society's silver plate and the Dr. Pickard Memorial Cup.

Highest score for potted plant with two scapes, in possession less than one year was Ludwig's 'Fire Fly', exhibitor Mrs. Clem Smith. She also received the Society's silver tray and the Mildred Triplett Memorial award.

In the Hybridizers Division, the following preliminary awards were given. First Preliminary award—Dutch Seedling, exhibited by Mrs. A. L. Hammond. Second Preliminary award—Dutch xx American Seedling, exhibited by Mrs. E. Johnstone.

Additional ribbon awards were given to members who had the best florets in each division. The Sweepstakes Award and Trophy was awarded to Mrs. J. L. Williams.

Fig. 7. Exhibits at 1975 Houston Amaryllis Society Show. **Top:** Amaryllis propagation from seeds—all stages to blooming bulb at extreme right. **Bottom:** feeding the Amaryllis plant—samples of soil, fertilizers and pest control, specimen insects; insecticides.

The focal point of interest always centered around the Educational Table which was a most interesting display showing the various stages of propagation of Amaryllis. There was soil, fertilizers, mulch, cut florets and pots of blooms of the Amaryllids grown in our area, all of which helped to broaden the interest of gardeners .Cultural information was freely given by the ladies in charge of the display and we are indebted to Mrs. Troy Wright and Mrs. Leo Hellman for this section.

In addition to the Horticulture Show, the Amaryllis Society exhibited in the Tri-Color Section of Houston Council of Garden Clubs, Inc. Twelve Artistic arrangements were entered, all using one or more Amaryllis florets in each arrangement.

SOUTHERN CALIFORNIA HEMEROCALLIS AND AMARYLLIS SOCIETY SHOW FOR 1975

C. D. Cothran, *Show Chairman,*
1733 North Gibbs St., Pomona, Calif. 91767

The eleventh annual show of the Southern California Hemerocallis and Amaryllis Society was held at the Los Angeles State and County Arboretum lecture hall in Arcadia on April 26 and 27. The theme of the show was SPARKLING STARS, and the theme was fully fulfilled as the flowers arrived, and the show began to take its form.

California had a very cold spring and the *Amaryllis* were slow to open. A week before the show it became a matter of great concern as to whether the Society should hold the show, but with three warm days we went from disaster to a marvelous spectacle. We had 12 exhibitors with about 200 entries, and several hundred cut scapes for display.

The crystal and silver trophies were arranged on the head table by Mrs. Gladys Williams, Show Standards Chairman. A beautiful bowl of soft pink and white *Amaryllis* from Mrs. Rosen was placed to add accent to them. The theme of the show was spelled out in sparkling cut out letters and stars on the wall behind by Mrs. Barbara Gardner. There were a number of beautiful arrangements with *Amaryllis* predominating by Mrs. Melton, Mrs. Harshbarger, Mrs. Macdonald, and Mrs. Rosen, all placed to excite the interest of our show visitors.

The following awards were made by judges Quinn Buck, Polly Anderson, Roger Fesmire, and senior judge Gladys Williams: Sweepstakes—C. D. Cothran, who received most blue ribbons was awarded the Cecil Houdyshell memorial trophy. Runner-up—John Cage, who received the Southern California Hemerocallis and Amaryllis Society Award. Ludwig Challenge Cup—C. D. Cothran for 'Apple Blossom' with a score of 95 points.

Registered *Amaryllis* Other Than Ludwig—John Cage with 'Big Tex' with a score of 95 points.

Best Flower in Show-Judges Award—'Big Tex' showed by John Cage.

Popularity Poll Winner—'Eastern Dream' showed by John Cage.

Hybridizer's awards were given to Henry Meyers for the best

Fig. 8. Outstanding double Picotee Type Hybrid **Amaryllis** exhibited by C. D. Cothran (not 'Double Beauty'). Photo by Phil Rosoff.

Leopoldii type seedling, a large and lovely red; to Ed Pineall for the best Reginae type seedling, which was also a large red; C. D. Cothran for the best small Leopoldii type seedling, a blush pink; to John Cage for best small red gracilis, and for the best belladonna type seedling.

Awards of Merit were given to: John Cage for 'Big Tex' and 'Eastern Dream'. C. D. Cothran for 'Apple Blossom' and 'White Giant'.

Preliminary Commendation Awards were given to: C. D. Cothran for Leopoldii type seedling colored blush pink, for a Leopoldii type seedling colored lime yellow, a large red Leopoldii type seedling, and for a picotee double. Henry Meyers for a large dark red, a large mauve red, and a frilly pink and white, all of the large Leopoldii type.

Rosettes were awarded to Mr. Angell, Mr. Ed Pineall, and to Mr. John Cage for their wonderful table displays of flowers. These table displays always prove to be a tremendous attraction to our visitors.

Fig. 9. Southern California Amaryllis Show, 1975. **Bottom:** General view of part of the show; **top:** Trophies awarded, and bowl of pink and white **Amaryllis** exhibited by Mrs. Rosen. Photos by Phil Rosoff.

Special Judges ribbons are given for unusual colors, and different and interesting flowers. This year Leonard Doran received one for *Amaryllis doraniae* in perfect bloom. This is a small pink trumpet species which has not been seen by very many people up to this time. Joe Werling received one for a nice plant of *Amaryllis papillio*. C. D. Cothran received one for a picotee double, another for an odd pink

veined in rose purple, and another for a lime green beauty.

A very fine educational exhibit was put up by Mr. Jim Weinstock, and as usual this was a great attraction. Small packets of about 15 seed were given to everyone who wanted them and several people were kept busy during the entire period of the show explaining how to grow them. Many said that seed given to them at the show last year were growing well. A number of new members were obtained as a result of this close contact with the visitors who numbered several thousand over the two day period.

SPRING EXTRAVAGANZA OF LOS ANGELES STATE AND COUNTY ARBORETUM

C. D. Cothran, *Show Chairman,*
1733 North Gibbs St., Pomona, Calif. 91767

Saturday and Sunday May 17-18, 1975

The Southern California Hemerocallis and Amaryllis Society was again asked to put in an exhibit of amaryllis and hemerocallis for the sponsoring organization, the California Arboretum Foundation, and the Los Angeles State and County Arboretum. C. D. Cothran, Quinn Buck, and Bob Melton agreed to put on the display for the Society. About 40 amaryllis were taken from Cothran's garden and 8 large tubs of hemerocallis from Buck's garden. Because of a late season the amaryllis were just at the heighth of their bloom, so some species, some primary hybrids, some Dutch seedlings, and some named Dutch were selected. These were arranged by colors and sizes so that the visitors could see what a wide range of each was available. The hemerocallis in tubs were of the newer varieties, and all with blooms. Most of the visitors who come to the Extravaganza come because they like flowers and gardens, so the exhibit really attracted a lot of attention.

The Extravaganza was open to visitors from eight to five both Saturday and Sunday, and Society members acted as hosts and hostesses during this time. Some 25,000 people visited the gardens during the two days and it is estimated that about half of them visited our exhibit.

1975 NEW ORLEANS INTRA-CLUB AMARYLLIS SHOW

L. W. Mazzeno, Jr.,
944 Beverly Garden Drive, Metairie, Louisiana

The Men's Amaryllis Club of New Orleans staged its annual Intra-Club all horticulture Amaryllis Show on April 5, 1975 at the City Park Backer Room. Trophies were awarded in three categories. The best 4-floret specimen, a "Trixie" was displayed by Holly H. Bowers, Jr.; best 3-floret specimen, "Glorious Victory" by Oscar J. Robert, Sr.; and best 2-floret specimen, "Flora Queen", also by Holly H. Bowers, Jr.

The Club's regular annual show was held on April 12-13 and is reported separately.

1975 GREATER NEW ORLEANS OFFICIAL ALL-HORTICULTURE AMARYLLIS SHOW

L. W. Mazzeno, Jr.,
944 Beverly Garden Drive, Metairie, Louisiana

On April 12-13, 1975 the Men's Amaryllis Club of New Orleans held its sixteenth annual all-horticulture Amaryllis Show. This year's Show was staged in the new Lake Forest Plaza Mall, New Orleans, La. The setting was ideal for presentation of a spectacular show. In keeping with the Club's practice competition was again open to the public who responded with 31 entries, winning 15 ribbons. Total entries were approximately 250.

With a beautiful specimen of "Melody Lane" Mr. A. T. Diermayer won the "Best in Show" rosette. This same specimen also merited for Mr. Diermayer the James Mahan Memorial Award for best registered and named hybrid, the Ludwig Challenge Cup and the MACNO Club Trophy for the best Ludwig hybrid, and the Laurence Mazzeno, Jr. Trophy for best miniature hybrid. His "Anzaldoi" won the Amaryllis Incorporated Award for best Amaryllis Species.

Most awards were taken by Mr. Holly H. Bowers, Jr. One of his "Orion" specimens won the W. J. Perrin Award, runner-up to the Mahan Award. Another took the Reuter Seed Co., Inc. Trophy for best cut flower. With "Beautiful Lady" specimens he captured the O. J. Robert, Sr. Trophy for best three-floret specimen and the Nola Luckett Trophy for best two-floret specimen. In addition he was awarded the George Merz, Jr. President's Trophy for most blue ribbons by a Club member, the Vincent Peuler Trophy for best registered single floret (Ludwig Dazzler), the Amaryllis Society of Baton Rouge Award for best unnamed single floret, and a Sweepstakes Rosette.

Mr. Vincent Peuler won the Member's Choice Rosette with a "Picotee Red Lining", and the Southern Seed and Popcorn Company, Inc. Trophy for runner-up in the breeder's section. The best breeder's hybrid merited the Robert Diermayer Memorial Award for Mr. Victor Pannell. Dr. T. A. Calamari, Jr. won the T. A. C. Construction Company Award for best unnamed and unregistered hybrid. Mr. L. W. Mazzeno, Sr. took the Edward P. Authement Trophy for runner-up to the T. A. C. Award. Mr. E. M. Beckham won a Sweepstakes Award.

The Show Chairman, Mr. A. T. Diermayer, worked untiringly to stage an excellent exhibition. In addition he personally handled the publicity for the Show as he has for several years. This included articles in major horticultural magazines and several TV appearances by members. He was assisted by Mr. L. W. Mazzeno, Jr., Co-Chairman, and all Club members. Special thanks go to all who participated in the Show. In particular we thank our Judges, donors of the trophies and other awards, and the members of the Amaryllis Society of Baton Rouge for their assistance.

PROPOSED CHANGE IN POINT SCALE FOR JUDGING AMARYLLIS SHOWS

Submitted by
L. W. MAZZENO, JR.,
944 Beverly Dr., Metairie, Louisiana 70002
for
The Men's Amaryllis Club of New Orleans, Inc.

The Men's Amaryllis Club of New Orleans, Inc. in 1975 staged its sixteenth annual official all-horticulture Amaryllis Show. Through the years our shows have been judged by the official point scale. We have felt for some time that some consideration should be given to the "pose of the specimen" (symmetry of florets about the scape). Our judges have also indicated to us their feeling that pose should be an important criterion in their decisions. Therefore, we are proposing that 15 points be added for "pose of the specimen". To provide for these additional points we propose a like reduction in "conformity to flower color standard". The complete point scale we propose is as follows:

POINTS IN HORTICULTURAL SECTIONS

	Single scape (Cut specimen)	Single scape (Potted specimen)	2 or more scapes (Potted specimen
Perfection of floret shape	15	15	15
Conformity to floret color standard	30	30	20
Pose (symmetry of floret about scape)	15	15	15
Floret size	15	15	15
Length and character of scape (stalk)	5	5	5
Number of scapes per plant	–	–	10
Number of florets per scape	6	6	6
Fragrance	2	2	2
Foliage	–	2	2
Condition of exhibit	12	10	10
	100	100	100

We sincerely hope that this proposal receives a favorable reply.

(**Editorial Note**—Judges should send in to the Editor **very brief summaries** of their thoughts on this subject for publication in the 1977 PLANT LIFE.)

2. LINEAGICS

[BIOEVOLUTION, DESCRIPTION, DETERMINING RELATIONSHIPS, GROUPING INTO LINEAGES]

AMARYLLIS SPECIES AND THEIR HYBRIDS

J. L. DORAN, *1117 N. Beachwood Dr., Burbank, California 91506*

Amaryllis pardina Hook. f.

The Flower of *Amaryllis pardina* is always 9″ or over in diameter with a white back. The face is white dotted red with petals the same width except the lower petepalseg which is about 2/3 width of others. There is a greenish throat. The flower blushes pale pink on aging if weather is hot. Plant is vigorous and multiplies rapidly, and does not require any kind of special culture. It requires a rest period of about two months at which time watering is greatly reduced. Here we moisten the soil only every couple of weeks during this period. The plant remains evergreen during rest period.

I believe that this would be a very good parent for hybridists to use because of its unique color pattern, large sized flower, vigorous plant, and its very flat flower. It has a very short tube.

Amaryllis fosteri Traub

A. fosteri is a unique plant which has up to twelve flowers per scape. I have had seedlings from it which had ten flowers. The flower is a soft salmon color with a hint of green on outside midrib near the ovary. The stamens are exserted and the flower, in many ways, reminds one of a Nerine. The surface of the petals are textured or reticulated. The largest bulbs are 8 cm. in diameter which produce the most flowers per scape, but bulbs as small as 3 cm. dia. will bloom. The scape is quite tall, usually about 3 ft. high and often is near 5 cm. diam. at the top of the bulb. The bulbs offset prolifically, soon filling the pot; even small bulbs offset. Some bulbs rest at any time of year, taking three or four months. Drenches of Benlate seem to benefit the plant. Two teaspoons per gallon are used. I prefer to plant it in a potting mix of ¾ fine sand and ¼ coarse organic material with powdered lime and super-phosphate added.

A. fosteri seems to cross readily and has produced a large number of seedlings. Crossed with *A. blossfeldiae*, it produced salmon pink tubular flowers from 4½ to 5 inches in diameter. Crossed with *A. lapasense*, it produced rosy-orange flowers 5 to 5½ inches in diameter which were very flat. Crossed with *A. doraniae*, it produced rose, salmon, and red flowers of 4 to 6½-inch diameter. One has marvelous pink (HCC 6 21/1 carmine rose) flowers. Crossed with No. 60, *Amaryllis brasiliana* Traub & Doran, it gave 6-inch diameter reflexed flowers of a nice color.

Amaryllis brasiliana Traub & Doran *

Bulb with tunics light brown, very thick and tough, 7.5-10 cm. in diam., 9-12 cm. long, bulb neck 10-15 cm. long. *Leaves* 8-11, deeply channelled, light green, arching, 70-90 cm. long, 4-4.5 cm. wide, narrowing to the bluntly acute apex. *Scape* 80 cm. long. *Spathe* 2-valved, upright, lanceolate, bluntly acute; bracteoles relatively smaller. *Umbel* 2-4-flowered; flowers horizontal, more than 20 cm. long, 16.5 cm. wide at the apex, narrowing to 6 mm. diam. at the ovary, *pure white,* with a strong, very pleasant *fragrance. Pedicels* 7.5 cm. long. *Ovary* elongated, 2.4 cm. long, only 0.7 cm. in diam. *Tepaltube* long funnell-shaped, 8.8 cm. long, 6 mm. wide at the base, enlarging gradually to 2 cm. at the apex. *Tepalsegs* oblanceolate, apices bluntly acute. Top setseg, 14.5 cm. long, 4 cm. wide in widest part; 2 lower petsegs 15 cm. long, 3.9 cm. wide in widest part; 2 upper petsegs 14.5 cm. long, 3 cm. wide in widest part; bottom petseg, 15 cm. long, 2.5 cm. wide in widest part. *Stament* attached slightly below the apex on the inside of the tepaltube; *stamen-filaments* arranged in 4 sets of lengths, 8.5-10.5 cm. long. *Anthers* 9 mm. long, 4 mm. in diam., pollen yellow. *Style* overtopping the stamens by 1.5 cm. *Stigma* trifid, lobes 3 mm. long.—*Hamilton P. Traub and J. L Doran*

The culture of this plant has not shown particular problems. I prefer fine sand with about 1/4 of coarse organic material and a little lime and superphosphate added. It seems to be a little sensitive to watering. It should not be watered until the pot has dried down to just moist. Feeding should be light and often. I prefer liquid fertilizer with a balance where the potash is as high or a little higher than the nitrogen.

Hybrids of *Amaryllis brasiliana* with *A. reginae* produced three-flowered scapes of HCC 821/3 currant red flowers. Tubes were 3-5 cm. long. Flowers were 5½ to 6½ inches in diameter and perfumed. This flower color is novel to amaryllis. Crosses with a hybrid which is (*A. evansiae* X *A. aglaiae*) X *A. evansiae*, it produced perfumed flowers 5 to 6½ inches in diameter of chartreuse color, some with pale rose striae on each side of the keel. Some had heavily ruffled petals. Crosses with *A. lapasense,* it produced seedlings with 6½ diameter

* **Amaryllis brasiliana** Traub and Doran, **sp. nov.** (Amaryllidaceae). Haec species floribus salviformibus stigmate trifido ab Amaryllis viridiflora (Rusby) Traub & Uphof et A. immaculata Traub & Moldenke foliis fere bis latioribus valvis spathae erectis 2—3-plo longioribus et ceteris recedit.

This species belongs to the trumpet-flowered group with the **trifid stigma,** and it differs from its nearest relatives, **A. immaculata** Traub & Moldenke and **A. viridiflora** (Rusby) Traub & Uphof, in having leaves nearly twice as wide, and spathe-valves erect and from 2-3 times longer. It differs also in other particulars. **Holomenifer:** No. 1132 (TRA), Feb. 12, 1973. Grown from bulbs collected 20 Km. w. Victor Hugo, Brasil, and flowered at Burbank, California. Named in honor of the great Federal Republic of Brasil. **—Hamilton P. Traub and J. L. Doran**

flowers with wide petals, all white face with red stripes or rows of red dots. Very beautiful. Almost all were perfumed, some had ruffles. Crossed with *A. traubii,* it produced flat 5½ to 6 inch diameter flowers with perfume. They were from pale pink to rose colored. Some were of outstanding good quality.

AMARYLLIS CALYPTRATA Ker-Gawler

HARRY BLOSSFELD, *Rua Pedro 360,*
Tremembe 02371, Sao Paulo, Brasil

(This article was received after the cuts for this issue had been made so that the illustrations sent by Mr. Blossfeld could not be used. However, Mr. W. Quinn Buck, of Arcadia, Calif., (see PLANT LIFE *18:* 130-132, fig. 19, 1962) has been successful in growing *Amaryllis calyptrata,* and he has published excellent pictures of this very unusual species. The readers should study these pictures in connection with Mr. Blossfeld's article.—*Ed.*)

This Brazilian species is little known and few people grow it, even if they have a good number of natural species in their collection. The reason may be, that it flowers out of the season, when most *Amaryllis* bloom and so enters but few exhibitions; its green flowers are anyhow more an oddity than a show piece. Moreover it requires a care somewhat different from other species, so that there may be a difficulty to grow it successfully. Yet this species has a character of its own, unforgettable and fascinating on behalf of color, shape and even perfume, though the latter may not be approved by all nostrils.

The plant has its native haunts in the forest-clad, dripping moist mountains of the Serra do Mar in southern Brazil, from São Paulo northwards to the Organ Mountains in the Rio de Janeiro State and some mountain ranges of Espirito Santo. Almost anywhere it exists, it will grow as an epiphythe, on the mossy, gnarled trunks of trees, though rarely above ten feet from the ground. The thick, very succulent roots creep a long distance in the fissures of the bark, through a thin layer of dirt and moss, exploring occasional pockets of humus accumulations. It will bloom twice a year, first in January, that is midsummer according to local conditions, and again in June, that means early winter in Brazil. The plant is in leaf the year round, and has no visible dormancy period.

Though there are several, and correct, descriptions of *Amaryllis calyptrata,* I venture to give mine, based on habitat observations and on a good number of plants, I am growing for several years.

Bulb rarely above 8 or 10 cm in diameter, pear-shaped clothed by grey tunics and practically above the soil surface. Roots thick, mostly on the surface, covered by velvety hairs.

Leaves from 8 to 10,, gutter-shaped, 50 to 60 cm long and at widest place 5 cm wide, minutely fluted by 18 to 20 parallel veins. The lower face has a prominent, sharp keel along the center. Leaf color is a deep green on both faces, some plants showing a pale crimson hue on under face near the base. The leaf tip ends in a narrow point. Foliage is

persisting through all seasons.

Peduncle 60 cm long, hollow, sub-cylindrical, 2.5 cm in diameter near the base, tapering to 1.5 cm at tip, green, somewhat glaucous.

Spathe 8 cm long, by 3 cm broad, two-valved, valves boat-shaped, withering, though still green at anthesis. Two bracteoles present, 5 cm long by 0.3 cm broad at base.

Pedicels 4 cm long and 1 cm across, when flowers start opening, but considerably longer when pods develop, cylindric, green.

Ovary inflated trigonous, 2 cm long by 1.3 cm in diameter, darker green, set at an angle, thus supporting flowers in a horizontal position.

Pod on 8 cm long pedicels, greenish yellow when splitting, measuring 6 cm in diameter, trigonous in shape and deeply constricted between the chambers. Apex a deeply sunk triangular scar, showing in the center the stump of what remains of the style. Each pod contains about 200 seeds, with an average weight of 1.2 grams per hundred, when dry after two weeks.

Seed quite large, 30 by 15 millimeters, oval in shape, flat and papery, clear brown, with margins a clearer grey colour.

Flowers generally two, in an opposite position, rarely three on a stem. Buds, when emerging from spathe, show a remarkable trigonal shape, with sharp edges. When they start opening, it can be noted that the extremely long stamens insides are folded back like fish-hooks; at anthesis they stretch straight and one can see their struggle to disentangle by spasmodical movements, until they get free and out of the bud.

Corolla soldered at base into a conical tube or 2.5 cm length. On the inside, this tube is closed by a green paraperigone that has the shape of a bladder with a triangular slit, through which stamens and style connect with the ovary. The cartilaginous rim of this paraperigone is somewhat undulated and where it is soldered to the tube, on the outside is clearly marked by a ring of tiny depressions.

Perigone has a peculiar shape, to which the name "calyptrata" alludes; *calyptra* means a hood. As before stated, the three outer segments are stiffened by a thick and prominent ridge running lengthwise along the center, thus giving the bud its trigonal shape. When the flowers open, this reinforced "backbone" of the outside segments keeps them in an inwardly curved position and prevents the flower to open wide. Consequently, the inner segments are unable to spread open and just pierce their tips through the clefts between the outer segments, rolling them finally to a spiral, in the vain effort to spread wider. The lowermost inner segment, being only 2.2 cm wide, has more room to spread and does so promptly, when the bud opens, curving back too, after a few days.

While this phantastic shape of a flower develops, the observer notes another exciting show. The *stamens,* hooked back while inside the bud, at first straighten and after a day, their enormous anthers, full 2 cm long and pale lilac, split lengthwise and tuck outside in, showing the greenish-yellow pollen, while they shrivel to a mere 0.8 cm length in two days. While this happens, the pale pink stamen filaments stretch

amazingly in length, until they protrude from the flower to a full 15 cm (6″) length; but they do not just grow longer; at the same time, they bend and twist, reacting quickly to changes of light direction and incidence of the sun. Finally they end their dance by bending their tips upwards. The *style* remains bent downwards during the first three days, then stretches to full 18 cm in length and finally bends up near the tip, staying in front of the anthers. The trifid *stigma* unfolds reluctantly and only spreads on the last days of life of the flower.

The most unusual colour of this flower is green, though some authors indulge in calling it yellowish-green or whitish-green, its general appearance is frankly green. On close inspection, one discovers, that the green colour is most decidedly present on the veinings, while what little space is left between these dense reticulations, is somewhat paler green and when the flower is past its best, some yellowish or whitish shades appear. A keen observer may even discover a tiny red rim along the edge of all flower segments, but it is so narrow, that one remains sceptic about it, unless one uses a lens. A faint purplish hue is also present on the outside of the flower spathe and, as stated above, *style* and stamen filaments are pink, except at their base, which is green.

This flower cannot be called a great beauty, but it is unusual and spectacular, it has a formal character and colour of its own and another feature is the strong perfume of exotic aroma, most active during the night. It possibly acts as an attraction for some big green bug, which has a similar smell and may be responsible for pollination. But the humming-birds too, are not quite innocent about the amorous life of this flower.

As to cultivation, it must be remembered, that the plant is evergreen, requiring light and water during the whole year. Furthermore it must be considered, that it comes from a rather cool mountain area (abt. 3000 feet altitude), with average temperatures of 65° F, with but little variations during the seasons (59° F to 70° F). It gets an immense rainfall of 160″ per year and whenever it does not rain, dense fogs are sure to prevail each evening and morning. The permanent moisture is supported by this plant by its epiphythic habit; growing on trees, rains drain off immediately and there is no danger of the roots to become asphixiated in a logged soil, because they are mostly superficial.

Translating these facts into the practice of cultivation, it is first evidence, that this species, contrary to most others, has no resting period and needs no dormancy. It requires high atmospheric humidity and a shady, cool place in the greenhouse. It should be potted high, that is, with the bulb entirely above the soil surface, and a very porous potting medium is adviseable. This not only requires more frequent watering, but also implies in regular fertilizing. Like most epiphythic plants, the *Amaryllis calyptrata* is rather sensible to high fertilizer concentrations and solutions above 1 : 1000 of any fertilizer formula, should be avoided. Very diluted fertilizer applicated frequently between plain water hosings is much better than strong solutions given two or three times per year, which other *Amaryllis* species of short growing cycle

may take easily.

A curious fact may be remembered. The closest relative species is *Amaryllis fosteri* Traub, a species growing in one of the driest desert regions of Brazil, perfectly adapted to resist extreme drought conditions, tropical heat and very little shade.

THE CHROMOSOMES OF **AMARYLLIS CAUPOLICANENSIS** CARDENAS [1]

WALTER S. FLORY AND GERALD SMITH
Wake Forest University

Only about one-third of the known *Amaryllis* species have had their chromosome numbers reported, and in many cases chromosome types and descriptions are not given for these. Traub (1963) includes 55 species in *Amaryllis* L., but a number of new species have been described in the last 12 years. Earlier Traub and Moldenke (1949) had listed 75 species for the genus, but revisions have since removed some of these species from *Amaryllis* into new or different genera. Bailey's (1949) estimated 70 species, and Willis' (1966) 75 (as *Hippeastrum* Herb.) compare well with the number considered by Traub and Moldenke in 1949.

Using the chromosome number lists compiled by Bolkovskikh, Grif, Matvejeva and Zakharyeva (1969), and by Moore (1973) we find that numbers have been reported for 25 species of *Amaryllis* L. All, except for a few very early and probably mistaken counts, have a basic (or X) number of 11. Of these 17 are diploids, with 2n=22. Polyploid 2n numbers of 33 (3 species), 44 (2 species), and of 55, 66 and 77—1 species each, are known.

In 1972 Martin Cardenas described, in PLANT LIFE, several new species of Amaryllis from Bolivia, among them *A. caupolicanensis* which is native in the Province which furnished the specific name Caupolican. Through the generosity of Dr. Thomas Whitaker we received several seed of this species in the late fall of 1971. These seed were planted December 20, 1971, and 8 of them germinated a few days later. Three of the resulting bulbs have been distributed. Of the five which remain the largest is now 4.5 cm in diameter, and a second over 3.5 cm across. These furnish a good supply of rapidly growing root-tips for cytological study.

Several of these tips have been pretreated in .2% colchicine for several hours and then squashed in 1% Gurr's acetic-orcein. The better slides have been made permanent for purposes of repeated study and photography.

The Chromosomes of **A. caupolicanensis** Card.

Many good metaphase figures have been available from dividing root-tip cells. A somatic chromosome number of 22 is readily observable

[1] Work supported by a grant from the Research and Publications Fund of Wake Forest University.

in many such cells (Fig. 10). The chromosomes in 5 mitotic metaphases have been measured with an ocular micrometer calibrated into mm (and microns) with the aid of a stage micrometer. Both total lengths, as well as lengths of individual arms, have been determined. The average lengths, for these, in microns, are recorded in Table 1, along with an

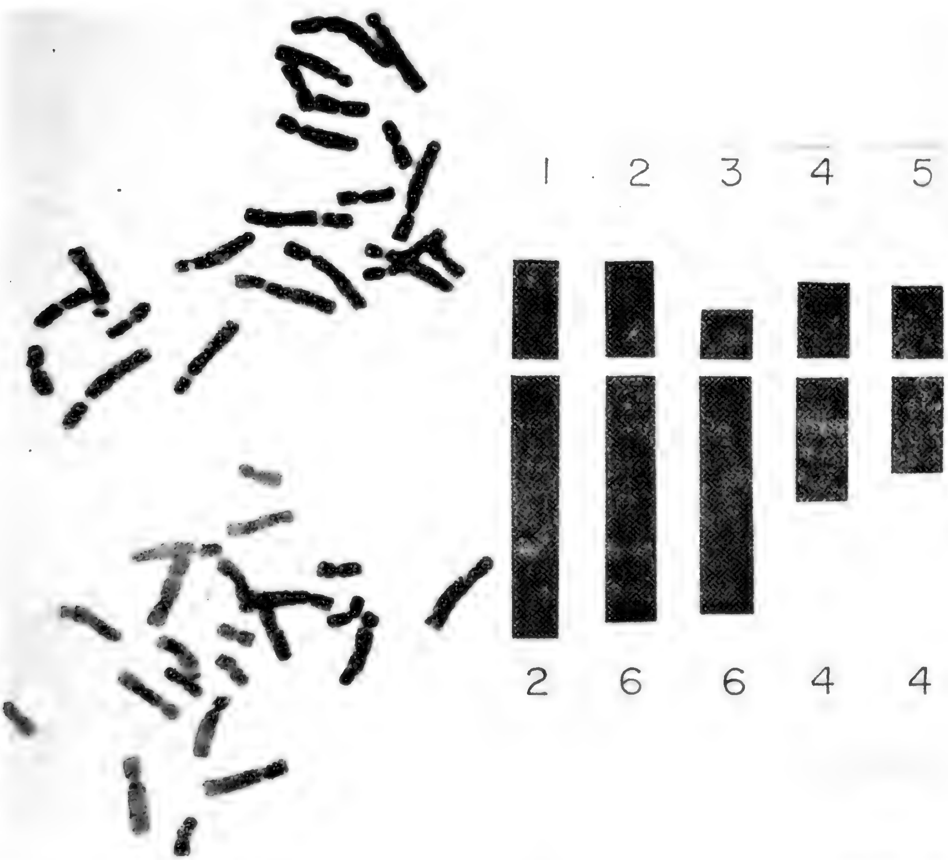

Fig. 10. **Left,** upper and lower plates: Chromosomes of **Amaryllis caupolicanensis,** photographed. X ca. 1320. 2n=22. The chromosomes have been somewhat shortened, and spread, by pretreatment with .2% colchicine for 4 hours. **Right:** Idiogram of the chromosomes of **A. caupolicanensis,** with type number above, and the number of chromosomes of each type below.

index determined by dividing the length of the short arm (S.A.) by the total length of a chromosome (T.L.)—an index indicating the centromere position (see Flory, Cicero and Smith, 1976).

Most of the chromosomes have subterminal centromeres, only the shorter ones being submedian, with the very shortest ones having their

centromeres rather near a median position. From the standpoint of length and centromere position, the chromosomes may be divided into 5 types as noted in Table 1, in the idiogram of Figure 10, and as may be observed in Figure 10. There are 2 chromosomes just slightly longer than 6 others. These two have long arms, and also centromere gaps (not well shown in the idiogram) which are slightly longer than the next six longest chromosomes. (The longer centromere gaps are quite apparent in the 2 longest chromosomes in Fig. 10) There are 6 chromosomes (chromosome 3 in Fig. 10) which have subterminal centromeres, and with their long arms about 5 times the length of the short arm. Then, there are 8 shorter chromosomes, with 4 of these being a little shorter than the other four, and all with centromeres in submedian position. No satellite chromosomes have been observed, probably because of the shortening resulting from the colchicine pretreatments.

Table 1. The types of chromosomes in **Amaryllis caupolicanensis** Cardenas, with total and individual arm lengths (following colchicine pretreatment) expressed in microns, and with S.A./T.L. indices.

Chromosome Type	Number	Chromosome-Length			S.A.*
		Total	Long Arm	Short Arm	T.L.
1	2	10.3	7.3	3.0	.29
2	6	9.6	6.8	2.8	.29
3	6	7.9	6.4	1.5	.19
4	4	4.8	3.0	1.8	.38
5	4	4.2	2.4	1.8	.43

* S.A./T.L. is the Short Arm length divided by Total Length.

The chromosomes of *A. caupolicanensis* may be compared with those of *A. belladonna* from the Dominican Republic, as well as with those of the species designated *Amaryllis solandriflorum*, from Brazil and Columbia, by Baldwin and Speese (1947). This may be best done by comparing the idiogram (Fig. 10) of this paper, with the idiogram for *A. belladonna* (Fig. 8, Flory, Cicero and Smith, 1976) and the karyotypes for *A. solandriflorum* in Figures 3 and 4 of Baldwin and Speese (1947). All 3 species have 22 somatic chromosomes. In *A. belladonna* each of the 11 pairs of chromosomes have differences from the other 10 pairs, with essentially 11 types being present. Baldwin and Speese found one unequal pair of chromosomes in some, but not all, of their plants. Except for this, the chromosomes of *A. solandriflora* are quite similar to those of *A. caupolicanensis.* Baldwin and Speese divide their chromosomes into 3 types: A (6), B (8) and C (8). If we combined our groups 1 and 2, as well as 4 and 5, *A. caupolicanensis* would have essentially the same types, and numbers of each type, as *A. solandriflora.* Both our Table 1 and Figure 3 suggest that this could be done, although there are slight measurable differences between our types 1 and 2, as well as 4 and 5.

SUMMARY

Amaryllis caupolicanensis, a new species from Bolivia described by Cardenas in 1972, has 22 somatic chromosomes. In this paper, these chromosomes are described, figured and divided into 5 types. They are found to be quite similar to the chromosomes of *Amaryllis solandri-*

flora, but quite different from those of *A. belladonna.*

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ZEPHYRANTHES BIFOLIA (AUBLET) ROEMER: ITS CHROMOSOMES AND SOME TAXONOMIC CONSIDERATIONS; AND THE CHROMOSOMES OF **AMARYLLIS BELLADONNA** L. *

WALTER S. FLORY,[1] JULIO CICERO [2] AND GERALD SMITH [1]

I. **ZEPHYRANTHES BIFOLIA** (AUBLET) ROEMER

The several opinions concerning the taxonomic position of *Zephyranthes bifolia* along with excellent descriptions of this and other species, were carefully expressed by the late H. Harold Hume in Herbertia, in 1939.

Carolus Plumier found this taxon on Santo Domingo, which he visited on at least one of his three voyages to America between 1689 and 1697, and began his description of the species as follows: "Lilio narcissus bifolius purpureus." In 1775 Aublet listed Plumier's plant under the binomial *Amaryllis bifolius.* William Herbert (1837) followed by Kunth (1850) and Baker (1888), placed this as a variety of *Zephyranthes rosea.* Roemer in 1847 indicated it as a doubtful species in the genus *Zephyranthes.* C. H. Wright (1914) described *Z. cardinalis* as a new species of *Zephyranthes,* but Hume's careful analysis shows Wright's plant to be the same taxon as the plant first discovered by Plumier.

Hume (1939) summarizes: "When all the characters of this plant are considered, it does not fit clearly into any genus now established. It differs from *Zephyranthes* in having stigmas that are quite broad

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and thickened (not filiform, thread-like or lobed), in filaments that are slightly curved at the tips (not upright), in a definitely declinate flower (not erect or suberect), and a spathe with bilateral tips (not unilaterally bifid). It differs from *Hippeastrum* in its tubular, inflated spathe (not two opposite single valves). Sealy (1937) has placed it in *Habranthus*, but it does not fit there exactly. It differs in its broad stigmas, its inflated spathe bilateral at the tip and in having filaments in two sets of lengths, not in four different lengths. For the present and until additional time and opportunity are afforded for study, it is here left in *Zuephyranthes*."

Traub (1951, 1952) recognized the marked difference between *Z. bifolia* and the other *Zephyranthes* species, and placed the former in a separate section *Sibonaya* Traub under the Genus *Zephyranthes*.

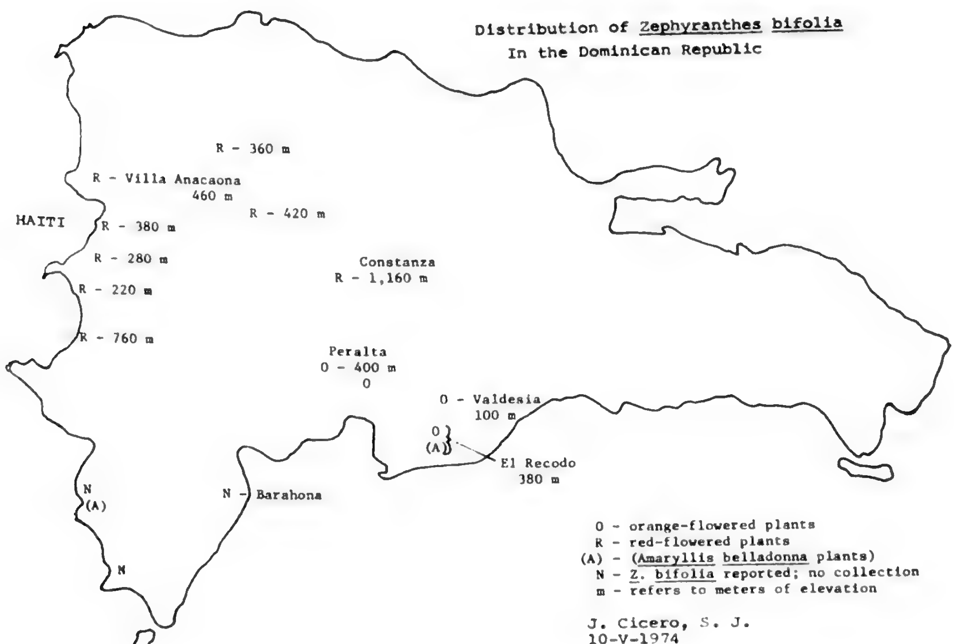

Fig. 11. An outline map of the Dominican Republic showing locations and elevations of clones of red-flowered (R), orange-flowered (O), and other (N) **Zephyranthes bifolia** types, and also of clones of **Amaryllis belladonna** (A).

Hume (1939) further added: "It has been suggested that *Z. bifolia (Z. cardinalis)* may be an hybrid (Sealy 1937). Since the

nativity of the plant has been established, there does not appear to be satisfactory basis for this assumption."

George Hamor, in the 1942 Herbertia, described the great variation in flower color, scape height, seed setting, etc., encountered among several hundred plants of *Z. bifolia* observed, and later cultured, in the Barahona Province of the Dominican Republic. Padre Cicero also notes this variation, and has found, especially along the International Highway separating Haiti from the Dominican Republic, simultaneous flowering of *Z. bifolia* forms with white, reddish or pinkish and vermillion flowers as well as others with a somewhat obscure dusky rose color. Further, he has noted variation in the form of the petals, with some being wide and others narrow, while some are flat and others are furrowed or keeled. Flowers having stigmas with four lobes have been seen.

In 1959 the chromosomes of *Z. bifolia* were studied and it was reported that 2n=60, with 5 pair of long chromosomes with medium centromeres being present (Flory 1959a, 1959b). Later Flory and Flagg (unpublished) studied additional material of *Z. bifolia* and apparently found some somatic mitoses in which 2n=72, and other showed somatic numbers of 2n=62, 2n=64, and perhaps other numbers in the sixties.

In 1974 one of the present authors, Padre Julio Cicero, S.J., sent to the workers at Wake Forest University a number of bulbs of *Z. bifolia* and two bulbs of *Amaryllis belladonna* L. The bulbs were collected at diverse locations and elevations in the Dominican Republic on the Island of Haiti—as listed in Table 1, and shown on the map in Figure 11.

It will be noted from Table I that Padre Cicero hybridized the *Z. bifolia* orange ("naranja") flowered form from Peralta, with pollen from the red ("rosado") flowered form from Villa Anacaona. Hybrid bulbs were also sent from this combination, which produced flowers of two differens colors, salmon and pink ("roja"), both of which are different from the colors encountered in the flowers of either parent.

Table 1. Bulbs from Dominican Republic received from Padre Julio Cicero, S.J., 1974.

Species	Location	Province	Elevation (Meters)	Date Collected	No.	Flower Color
Zeph. bifolia	Constanza	La Vega	1,160	5/ 5/74	2	red (rosado)
Zeph. bifolia	El Recodo	Peravia	380	5/11/74	2	orange
Zeph. bifolia	Peralta	Azua	400		8	orange
Zeph. bifolia	Villa Anacaona	Dajabon	460	2/11/74	2	red (rosado)
Zeph. bifolia	Valdesia	San Cristobal	100	3/10/73	2	orange
Zeph. bifolia hybrid	Orange (Peralta) X (Villa Anacaona)	red (rosado)		X4/19/72	2	salmon
Zeph. bifolia hybrid	Orange (Peralta) X (Villa Anacaona)	red (rosado)		X4/19/72	2	pinkish (rojo)
Amaryllis belladonna L.	El Recodo	Peravia	380	5/11/74	2	orange-red

One of us (Padre Cicero) has observed two very distinct varieties (of *Z. bifolia*), one with flowers of a clear red color that grows in the north in the central mountain ranges more or less associated with *Pinus*

occidentalis, with these flowering only during the spring. The second variety has flowers of an orange color and is found toward the south of the central mountain range in moderately humid forests, and this variety flowers all year long. Further, in the south where the orange-flowered *Z. bifolia* occurs are found separated but not entirely isolated populations of *Amaryllis belladonna* L., which also have orange flowers. The possibility suggests itself of natural hybridizations having ocurred between *Z. bifolia* and *A. belladonna,* with the orange-flowered forms of the former deriving from genes of the latter. Such a possibility has been tentatively considered and investigated.

CYTOLOGICAL STUDIES

Materials and Methods

The bulbs collected by Padre Cicero in 1974 were the materials studied. Cytological preparations were made of all lots listed in Table 1.

The cytological preparations were root-tip squashes, in 1% Gurr's acetic-orcein, following pretreatment for 3 or 4 hours in .2% colchicine. The better temporary preparations were made into permanent slides, permitting more time for both initial study as well as for subsequent rechecking.

The Chromosomes of **Zephyranthes bifolia** (Aublet) Roemer

One of us (G. Smith) has made numerous cytological preparations from rapidly growing root-tips of each of the accessions listed in Table 1, and the best of these have been the subject of extensive studies by both Flory and Smith, at magnifications of X900 and X1800.

All accessions have the same somatic chromosome number, 2n=60. At times, especially following heavy pressure in squashing, the arms of several of the larger chromosomes are sometimes forced apart. Sometimes the resulting centromere area is so extended that it is easy to at first consider that there are two chromosomes, when actually one is observing the two arms of one and the same chromosome. This, quite apparently, accounted for the chromosome counts above 2n=60, which had been made earlier (see above).

Both arms of each chromosome, of 4 mitotic metaphases in which the chromosomes were well scattered, were measured with an ocular micrometer calibrated into mm (and microns) with the aid of a stage micrometer. These chromosomes vary slightly in length, from cell to cell, due to varying contractions resulting from the colchicine pretreatments. The different chromosome types, however, are quite proportional, and readily recognized, in the different figures. Data for the chromosomes of the four divisions were averaged, and these averages are presented in Table 2.

In addition, an index figure indicating the position of the centromere in the chromosome was calculated. This is presented in the right hand column of Table 2. The index was secured by dividing the length of the short arm by the total length of a given chromosome (S.A./T.L.).

If this index figure is .5 the centromere is median in position, with the arms being of equal length. The less the index, the nearer is the centromere to one end of the chromosome, and the greater is the proportional difference in arm lengths.

Table 2. The classes of chromosomes in **Zephyranthes bifolia** (Aublet) Roemer, with average total, and individual arm, lengths (following colchicine pretreatment) expressed in microns, and with S.A./T.L. indices.

Class by length		Number	Chromosomes length: Total	Longest Arm	Shortest Arm	S.A.* / T.L.
longest	1A	4	14	7.5	6.5	.46
	1B	4	11	6	5	.45
intermediate	2A	8	8	5.5	2.5	.31
	2B	18	6	3.5	2.5	.41
shortest	3A	6	4	2.5	1.5	.38
	3B	20	3	1.5	1.5	.5

* Division of S.A. (short arm) length by T.L. (total length)

From Table 2 it will be noted that there are, in general, three types of chromosomes. There are eight longer chromosomes, 26 chromosomes which are of more or less intermediate length, and 26 quite short chromosomes. Further, each of these 3 general groups may be divided into 2 subgroups. Of the longer chromosomes, all 8 have submedian centromeres, with one arm just slightly longer than the other; 4 of these however, are somewhat longer than the other 4. The chromosomes of intermediate length have a group of eight slightly longer ones, which are essentially subterminal with respect to centromere position—one arm being less than half as long as the other. Then there are the 18 slightly shorter intermediate-lengthed ones, which have centromeres in submedian position. Of the shorter chromosomes, there are 6 slightly longer than the other 20. These 6 longer ones have their arm lengths in the ratio of 4 to 6, and their centromeres may best be designated as submedian in position. The shortest ones have almost exactly median centromeres, with the two arms of each being of equal lengths.

Figure 12 shows the 60 well scattered metaphase chromosomes of one mitotic division, the wall of whose cell was ruptured under the pressure of squashing. Figure 12 also shows the same squashed cell photographed at a higher magnification, and further enlarged to give more details of the chromosomes. Figure 12 further shows the 60 chromosomes within an intact cell, with unbroken wall; each of the chromosomes in this plate could be easily distinguished and counted by use of the fine adjustment on the microscope. A number of similar cells, of both types, were observed and studied.

Figure 13 presents an idiogram of the types of chromosomes occurring in *Z. bifolia*. The number, or type, is placed above each chromosome. The number present in the usual complement, of each different chromosome type, is shown by the number below each diagrammatic unit.

A Comparison of **Z. bifolia** Chromosomes with Those of Ohter **Zephyranthes** Species

The chromosome number of 2n=60 for *Z. bifolia* is unique for this genus, so far as known. Other somatic numbers for *Zephyranthes* species

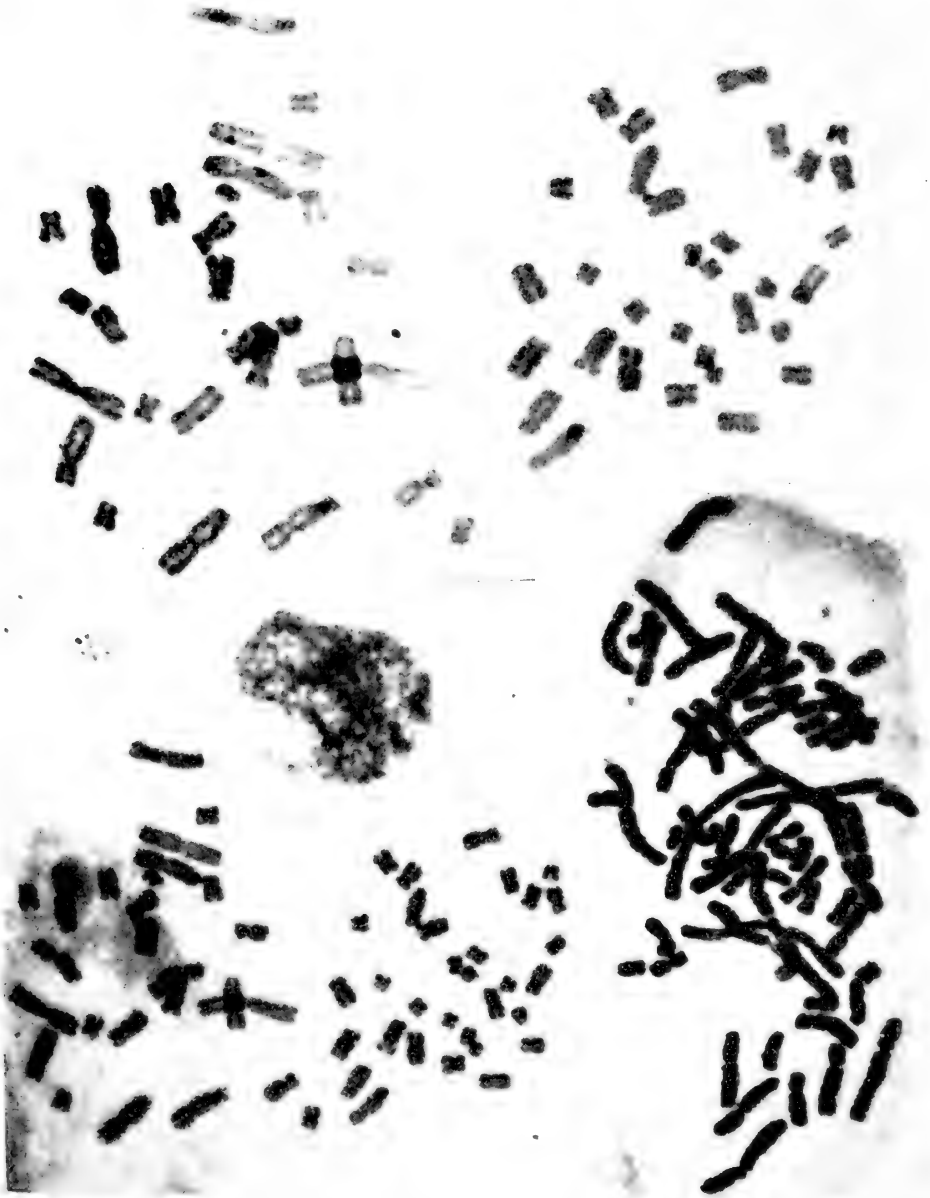

Fig. 12. **Top:** Mitotic metaphase from root-tip cell of **Zephyranthes bifolia.** 2n=60, cell wall was broken in squashing. **Lower left:** The same mitotic metaphase as shown on top, but at lower magnification. **Lower right**, Mitotic metaphase from root-tip cell of **Z. bifolia**, showing 2n=60 chromosomes in a dividing cell with an unbroken wall.

range from 18, through 24, 25, 28, 36, 43, 48 and about 96 to one with about 108 (Flory, 1968). The numbers 48, and then 24, are most frequently encountered. In general, the types and proportional lengths of chromosomes in *Z. bifolia*, however, are quite similar to those in other species of this genus as well as of *Habranthus*. For example, for similarly prepared material of *Z. insularum* (2n=28) the chromosomes range in length from 3.5 to 14.5 microns, with the S.A./T.L. indices running from .46 down to .25; while in *Z. nervosa* (2n=24), the lengths are from 4 to 12 microns, and the indices from .47 to .31 (Flory, 1959). The chromosome statistics—except for number—for these two (and other) species, therefore, are quite comparable with respect to size and centromere position with those of *Z. bifolia*. Good preparations of somatic mitosis in *Z. bifolia* do give the impression of having a greater proportion of quite short chromosomes per cell, than is usual for *Zephyranthes*, and the data in Table 2 lend support to the observation.

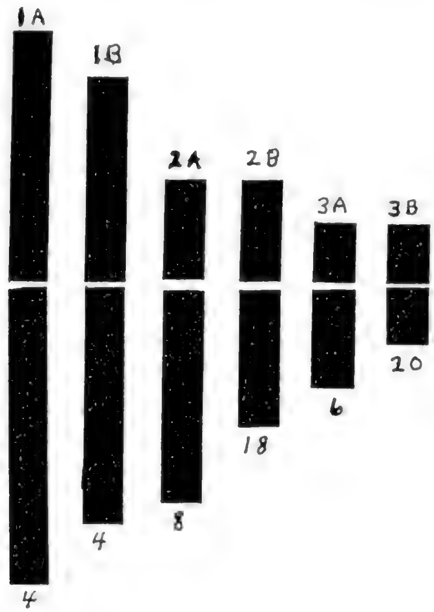

Fig. 13. Idiogram of the types of chromosomes (numbered at the top) found in somatic cells of **Zephyranthes bifolia**, with the number (below) of each types of chromosome in the complement.

II. THE CHROMOSOMES OF **AMARYLLIS BELLADONNA** L.

And a Comparison of These with Those of **Zephyranthes bifolia**

A number of workers have reported on the chromosomes of *Amaryllis belladonna* (including Inariyama, 1937; Sato, 1938 and 1942; Ficker, 1951; and others).

However, as stated earlier, this species is represented at several places in the southern parts of the Dominican Republic, and sometimes grows in close proximity with orange-flowered clones of *Z. bifolia*. Since the orange, or orange-red flowers of *A. belladonna* are quite similar in color to those of the orange-flowered *Z. bifolia*, it seemed desirable to compare the chromosome types of these two species. As observed, by previous workers, *A. belladonna* has 22 somatic chromosomes (Fig. 14). Each member of one subterminal pair (chromosome 5) bears a small satellite. The satellite is dimly apparent on one pair of chromosomes in Figure 14, but in the complement in which the chromosomes have been shortened more by the colchicine pretreatment, the trabants are not visible.

Fig. 14. Mitotic metaphases from root-tips cells of **Amaryllis belladonna** L. 2n=22. The chromosomes of the plate, **on the left,** were more affected and shortened by the colchicine pretreatment, than were those on the plate **to the right.**

Figure 15 depicts an idiogram of the 11 types of chromosomes found in *A. belladonna*.

A comparison of the chromosome complements of *Z. bifolia* and *A. belladonna* does not show many similarities. In the complements measured the average chromosome length in the former is 6, and in the latter 11.5 microns—although varying effects of the colchicine pretreatments on chromosome coiling and shortening could be partly responsible for the differences. *Z. bifolia* has 28—almost half—of its chromosomes with either median or near median centromeres (Table 2), and all chromosomes of its complement taken together have an average S.A./T.L. index of .43. In *A. belladonna* there is only one pair of chromosomes with median centromeres, and only two other pairs that approach this

condition (Table 3); the average index for all chromosomes here is .32.

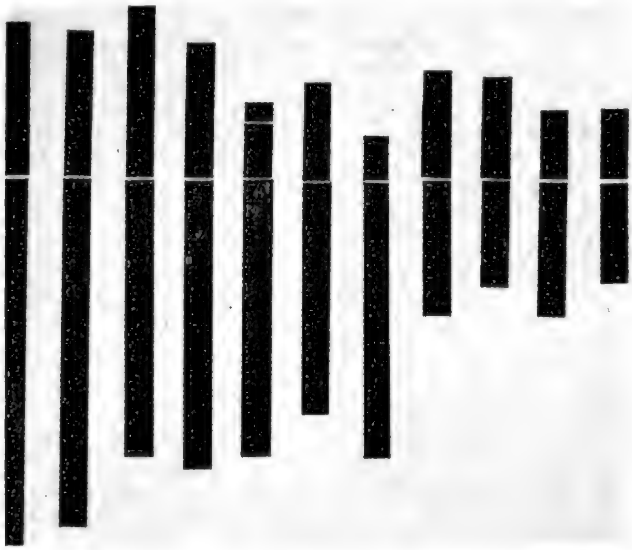

Fig. 15. Idiogram of the types of chromosomes in **Amaryllis belladonna** L. (2n=22).

So far as can be cytologically detected, then, there do not appear to be any chromosomes of the *A. belladonna* size and types, in the *Z. bifolia* complement. If hybridization has occurred between these two taxa there is no easily apparent cytological evidence for it. In addition, more than a dozen cross-pollinations of *A. belladonna* with good amounts of *Z. bifolia* (orange) pollen have been made in 1975, and an approximately equal number of reciprocal pollinations. No sets, or initiation of sets, have resulted from any of these attempted crosses. These results indicate the difficulty of successfully crossing these two taxa, under controlled conditions at least.

Table 3. The classes of chromosomes in **Amaryllis belladonna** L., with total, as well as individual arm, lengths, expressed in microns, and with S.A./T.L. indices.

Chromosome Number	Chromosome Length: Total	Long Arm	Short Arm	S.A.*/T.L.
1	18.6	13.4	5.2	.28
2	16.7	11.8	4.9	.29
3	15.2	9.4	5.8	.38
4	14.3	9.7	4.6	.32
5	11.8	9.4	1.8+.6	.20
6	11.2	7.9	3.3	.29
7	10.9	9.4	1.5	.14
8	8.2	4.6	3.6	.44
9	7.2	3.6	3.6	.50
10	7.0	4.6	2.4	.34
11	5.8	3.4	2.4	.41

* S.A./T.L. equals Short Arm length divided by Total Length.

DISCUSSION

Zephyranthes bifolia is quite distinct from any other known representative of the genus, in certain of its flower colors; in its wide range of flower colors under natural conditions; in the stigma, filament, flower inclination, spathe and other character differences pointed out by Hume, Hamor, and others, and in its chromosome number.

This species offers attractive opportunities for attempted hybridizations with other *Zephyranthes* species, with *Habranthus* species, and perhaps with other amaryllidaceous plants. Such further studies offer the possibility of throwing additional light on the relationship, origin and phylogeny of this colorful and interesting taxa. Further, there exists a good possibility of securing some interesting, and perhaps spectacular, hybrids by the use of *Z. bifolia* in a breeding program.

SUMMARY

This work describes in detail the somatic chromosomes of the Dominican *Zephyranthes bifolia.* The study has been made on both the red and the orange flowered types, as well as on variants of these. In this species 2n=60, a unique number for this genus. In addition, the chromosomes of *Amaryllis belladonna* from the Dominican Republic have been studied and compared with those of *Z. bifolia.* There are practically no chromosome similarities between the two taxa, and limited efforts to cross them have failed.

Zephyranthes bifolia has a number of similarities with, but also a number of differences from, other *Zephyranthes.* There remains much to determine concerning its origin and relationships. The variety, beauty, and size of its flowers make it a promising parent for hybridization studies aimed at producing useful new horticultural types.

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AMARYLLID NOTES, 1976

Hamilton P. Traub

Clivia x *cyrtanthiflora* (Van Houtte) Traub, *comb. nov.* Syn.—*Imatophyllum cyrtanthiflorum* Van Houtte, Flore des Serres, Ser. II. viii (1869) 87, pl. 1877; err. *Imantophyllum* in Benth. & Hook. f., Gen. iii. 729. 1883.

Allium traubii Howard, Plant Life 23; 61-62; 91. 1967; 23: 138. 1968.

A detailed examination of the flower in 1975 has revealed that the ovary is definitely shortly 6-crested. However, as the ovary swells after anthesis, the very short crests gradually disappear.

MIERSIA CHILENSIS, Poso & Zoellner, continued from page 120.

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REGISTRATION OF NEW AMARYLLID CLONES

MR. JAMES M. WEINSTOCK, *Registrar*
10331 Independence, Chatsworth, Calif. 91311

This department has been included since 1934 to provide a place for the registration of names of cultivated **Amaryllis** and other amaryllids on an international basis. The procedure is in harmony with the International Code of Botanical Nomenclature (edition publ. 1961) and the International Code of Nomenclature for Cultivated Plants (edition publ. 1958). Catalogs of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, **"Descriptive Catalog of Hemerocallis Clones, 1893-1948"** by Norton, Stuntz and Ballard was published in 1949. Additional catalogs of cultivars have been published since 1949: **Catalog of Brunsvigia Cultivars, 1837-1959,** by Hamilton P. Traub and L. S. Hannibal, PLANT LIFE 16: 36-62. 1960; Addendum. PLANT LIFE 17: 63-64. 1961; **Catalog of Hybrid Nerine Clones, 1882-1958**, by Emma D. Menninger, PLANT LIFE 16: 63-74. 1960; Addendum, PLANT LIFE 17: 61-62. 1961; **The Genus X Crinadonna,** by Hamilton P. Traub, PLANT LIFE 17: 65-74. 1961; **Catalog of Hybrid Amaryllis Cultivars, 1799-1963,** by Hamilton P. Traub, W. R. Ballard, La Forest Morton and E. Authement, PLANT LIFE. **Appendix** i-ii + 1-42. 1964. Other catalogs of cultivated amaryllids are scheduled for publication in future issues. These may be obtained at $7.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Jolla, Calif. 92038.

The registration activity of the American Plant Life Society was recognized when at the XVIth International Horticultural Congress, Brussels, 1962, the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for the cultivars of **Nerine;** and this was extended to include all the **Amaryllidaceae** cultivars, excepting **Narcissus** and **Hemerocallis,** at the XVIIth International Horticultural Congress, 1966.

Only registered named clones of **Amaryllis** and other amaryllids are eligible for awards and honors of the American Amaryllis Society at Official Amaryllis Shows.

Correspondence regarding registration of all amaryllids such as **Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis,** and so on, should be sent to Mr. Weinstock at the above address. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

REGISTRATION OF NEW AMARYLLIS CLONES, 1975

Registered by Dr. John M. Cage, 1041 Ruth Av., Yuba City, Calif. 95991

Amaryllis clone **'Cage's Coral'** (Cage, 1975); **A-1007;** U-4 to 5 fld; 26– h; perigone 2¾" long, 8½" across a flat but slightly recurved face, Chinese Coral (HCC 614/1). Vigorous and long-lasting winter bloomer with a narrow picotee around all segs, and bearing two scapes.

Amaryllis clone **'Marlys'** (Cage, 1975); **A-1008;** U-4 to 5 fld; 25" h; perigone 3" long, 8½" across a slightly recurved face which is white overlayed with a dramatic flush and picotee of claret rose (HCC 021). Winter-spring bloomer with slightly wavy edges, deep rose ring in the throat, and bearing two scapes.

Amaryllis clone **'Myra'** (Cage, 1975); **A-1009;** U-4 fld; 12" h; perigone 1¾" long, 3¼" across face, solid dark red (R. H. S. 46B) both front and back of segs. Winter bloomer with very regular flower form, florets tilted slightly upward, and pointed segs which are ¾ imbricated.

3. GENETICS AND BREEDING

BREEDING THE "HADECO" AMARYLLIS HYBRIDS

F. Barnhoorn, Jr., *P. O. Box 7, Maraisburg, Transvaal Republic of South Africa*

When the firm, Harry Deleeuw Company, started its *Amaryllis* breeding project in 1948, there was no summary of Amaryllis breeding available such as Traub's 1958 book, nor any studies on *Amaryllis* inbreeding (Cage, 1975). We had however the end results achieved by the many English and Dutch *Amaryllis* hybridists over a century, from Ker & Co., in England to Ludwig & Co. in the Netherlands (see Traub, 1958). We hereby wish to express our gratitude for this wonderful heritage. We have attempted to use this vast reservior of germ plasm to increase the number of outstanding *Amaryllis* clones available to the world.

Thus, the exact origins of our stocks of *Amaryllis* are not known due to the breeding methods used by our predecessors (see Traub, 1958). Mr. Barnhoorn started by crossing hybrid named clones from various firms in the Netherlands with a clone obtained in South Africa, named 'Dr. Pont'. Many crosses between these gave rise to our modern clones propagated vegetatively.

To qualify for acceptance a new hybrid clone has to conform to or surpass some very stringent criteria.

Points taken into account are the following:

(1) Number of blooms per stem.
(2) Number of stems per bulb (size of bulb taken into account).
(3) Length of stems.
(4) Time taken from potting till flowering (time of potting taken into account viz-early or late in season).
(5) Clarity/Pureness of colour as sought.
(6) Shape and general appearance of blooms.
(7) Size of individual blooms.
(8) Public acceptance of colour.
(9) Sturdiness of stems.
(10) Aspect of blooms in relation to stem and to other blooms on the same stem.
(11) Ease of and dependability in forcing (important for commercial potplant growers).
(12) Size of bulb needed to produce 2 good stems.
(13) Time-lag between appearance of first and second flower stem.
(14) Lasting time of blooms.
(15) Whether plant produces foliage together with—or after flowers.
(16) Ability of bulbs to reproduce fast by vegetative means naturally (i.e. number and size of off-shoots formed per year).
(17) Growth-rate of bulb per year.

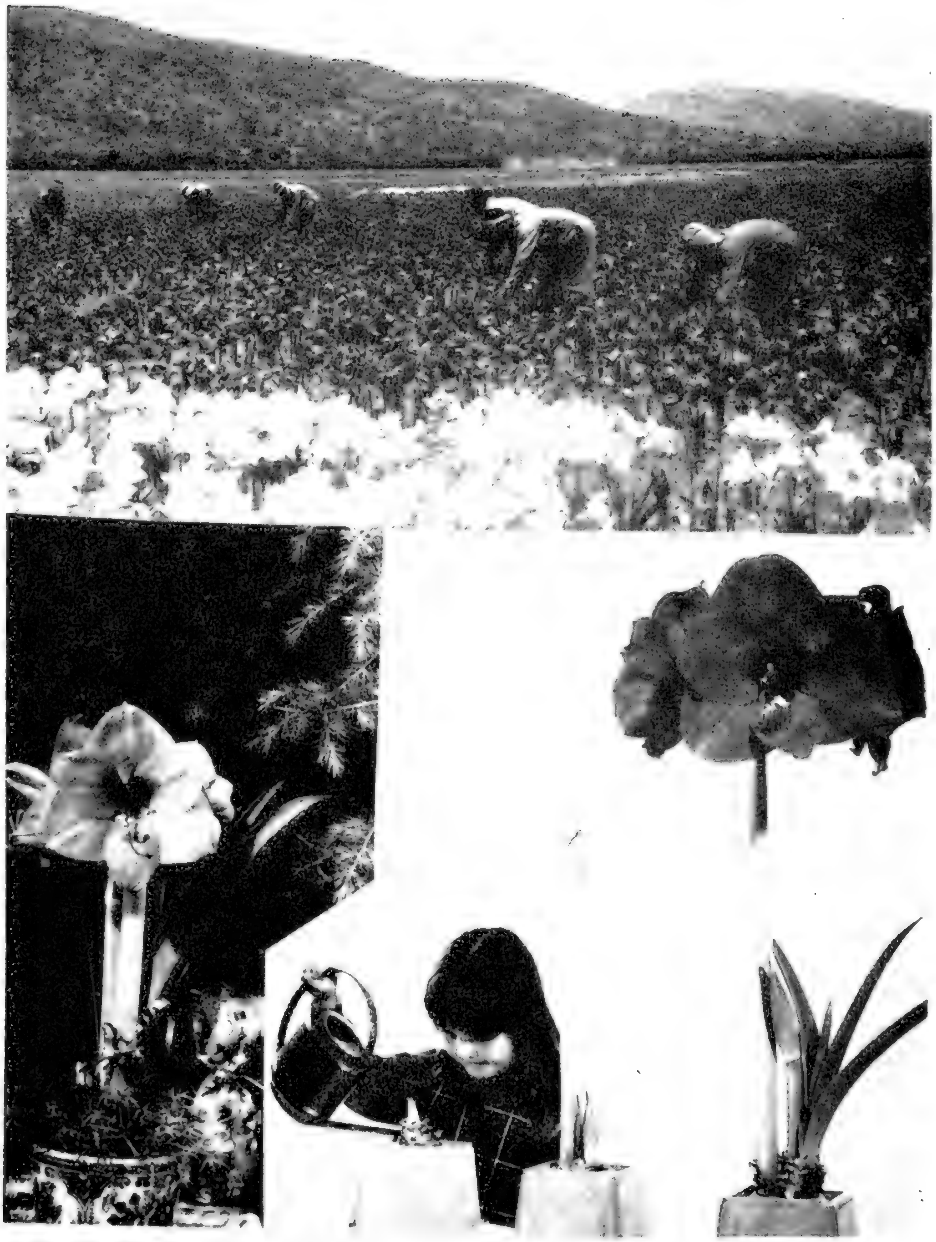

Fig. 16. "Hadeco" Hybrid **Amaryllis. Top:** workers in **Amaryllis** field at "Hadeco" farm near Johannesburg. **Lower left:** "Hadeco" clone 'Bold Leader' packaged as a Christmas gift. **Lower right**, little girl watering pots of clone 'Africana', and the clone in flower after six weeks.

(18) Resistance to disease.
(19) Shape and general appearance of the bulb.
(20) Condition of root-system.
(21) Ability of bulb and roots to stand up to long periods of storage under controlled temperatures.

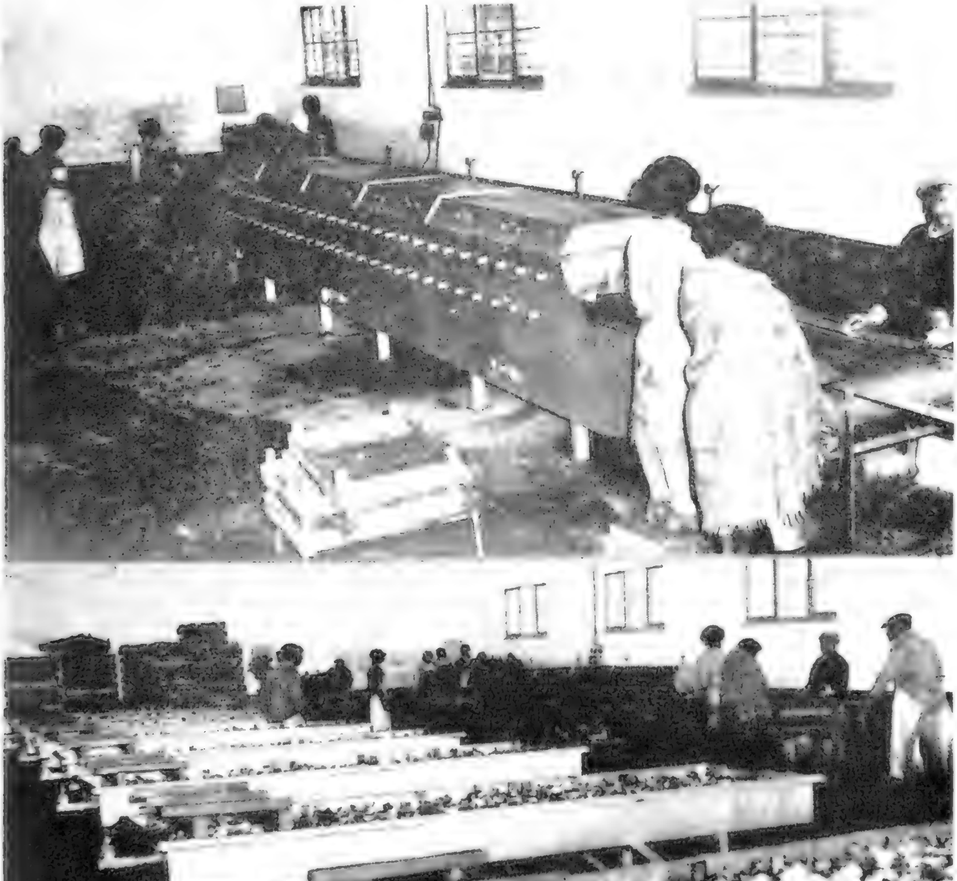

Fig. 17. "Hadeco" Hybrid **Amaryllis. Top:** machine capable of washing 50,000 **Amaryllis** bulbs per day. **Lower**, dipping trays in which bulbs are left in fungicide solution for 15 minutes after washing.

At the present time some 15,000 hybrids are tried out every year. In the past however when Mr. Barnhoorn was going all out to

get a good white and good pure pink variety some 2 acres (comprising ± 90.000 bulbs) was planted out with crosses. For the whites alone, some 400 numbered hybrids were in our books, from which the best 2 were selected to remain for cultivation and sale.

The method of obtaining a new variety through hybridizing is as follows:—

Say that one has an Amaryllis which produces large red blooms. This plant however has the following faults or drawbacks:

Fig. 18. "Hadeco" Hybrid **Amaryllis: Left,** the farm at Brits where about 50% of the bulbs are grown, viewed from the air. **Right,** temperature and humidity controlled chamber for storage of **Amaryllis** bulbs.

(a) The shade of red is too "light" and "flat". (b) The stems are too short. (c) The plant often produces only 2 to 3 blooms per stem and only 1 stem per bulb.

The method to follow then is to cross this variety with a dark red variety which is very free flowering and has tall stems. The blooms of this variety may be small.

The resulting hybrids will have characteristics of both parent plants plus others from previous generations. The resulting hybrids have not

only inherited the best points of the parents however. About 99.9% of the hybrids will be discarded because they will be inferior to the mother plant.

The parentage of the resulting new varieties is kept secret because it has been found that same varieties produce a high percentage of good offsprings while most do not. These "good" parents are therefore repeatedly used in the hybridizing program, the variety used being dependant on the improvements wanted.

A complete record is kept of every cross together with all its characteristics as outlined above.

When a batch of new hybrids flowers for the first time, the first step is to number the plants which show outstanding points. Such a numbered hybrid is then increased and tried out for 5 more years. If, in the meantime a better hybrid has come to light, the first one is discarded. If on the other hand the numbered variety comes up to all expectations it is increased as rapidly as possible through off-shoots. Such a variety is then given a name and offered for sale by sending sample consignments and photographs to selected trade customers throughout the world. A variety is ready for commercial sale about 9 years after its seed was first sown out. After that time about a 1.000 full size bulbs will be available.

The largest selling single varieties at present are "Bambara" and "Zanzibar" which are both signal red. Of each of these varieties some 120.000 bulbs are sold yearly at present. These 2 varieties were both hybridized in 1952. They flowered for the first time in 1955. These 2 varieties are forcing varieties and are extremely dependable. The bulbs of these varieties are practically all sold to potplantgrowers because of their dependability and ease of forcing.

The Company does not distribute its Amaryllis bulbs retail. Only the trade is supplied.

LITERATURE CITED

Cage, John M. Breeding and Culture of Amaryllis. Plant Life *31:* 65-72. 1975.

Traub, Hamilton P. The Amaryllis Manual. Macmillan Co., 1958.

A CODE SYSTEM FOR PLANT BREEDERS

JOHN M. CAGE, *1041 Ruth Ave., Yuba City, California 95991*

When one breeds amaryllis or other genera over a period of several plant generations, identification and the keeping of records become laborious and confusing. When two or more generations of plant breeders are involved in a project, a good code (or identification) system is of utmost importance. The lack of a good system has resulted in much time-consuming labor, many errors, and probably the loss of whole breeding programs upon the death of breeders.

The simplest way to label a seedling is to assign a separate number

to it and record the number and parentage in a notebook, but after a while one must carry the notebook with him and search endlessly in it to identify a particular seedling.

The classical method of describing a cross is to label it A ♂ x B ♀ when the pollen of plant A is used on the stigma of plant B. The little symbols that tell which is the male parent, and which the female, are a bit of a nuisance to me and to printers, and I notice that many breeders just assume that A x B means that A is the male or pollen parent. I do not quarrel with the scientific notation in its usual application, but it falls short as a way to record clearly the maximum information in the minimum space. Neither do I suggest that the coding system described here is the only solution to the problem. It has served me well for many years, however, and it may be useful to others.

Assume that a breeding program starts with several plants, each of which is designated by either a number, a letter, or a convenient abbreviation. For instance, let us start with the named amaryllis clone "Fire Dance," the Species *A. aulica,* and a special selection from a group of inbred siblings numbered 127. First we assign a letter to each sibling of interest—127A, 127B, etc. The following designations are easy to remember:

F (for "Fire Dance")
AUL (for *A. aulica*)
127A, 127B, 127C, etc.

A cross between two plants is shown by a fraction, with the numerator always the pollen parent. Thus the pollen of "Fire Dance" on *A. aulica,* would be either

$$\mathrm{F/AUL} \qquad \text{or} \qquad \frac{\mathrm{F}}{\mathrm{AUL}},$$

and we choose seedling C of this cross for further work, giving us

$$\frac{\mathrm{F}}{\mathrm{AUL}}\,\mathrm{C}.$$

However, if we use the first form of fraction, we seem to have an ambiguity in F/AULC, for AULC could be the C selection of a group of *A. aulicas,* and we indicate that C belongs to the fraction as a whole by the dot in F/AUL·C.

Now 127B is crossed on F/AUL·C, giving 127B//F/AUL·C, where the double fraction bar takes precedence and clearly indicates that 127B was crossed upon the previous cross of F/AUL·C. The D selection of the final cross is 127//F/AUL·C·D. Since two dots appear before D in the whole symbol, then D refers back to two preceding fraction bars. To summarize or to practice, look at

22/23///24/25·A//26B·C·D

which indicates several generations of breeding. Plant 22 was crossed on 23, 24 on 25, and the A selection of 24/25 was used. Then 24/25·A was crossed on 26B, and the selection 24/25.A//26B.C was made. Next,

22/23 was crossed on 24/25·A//26B·C and the final selection D was made.

The fact that there are three dots before D and four fraction bars may seem inconsistent at first, but plant 23 cannot be considered separate from 22 in the complete formula. It might even be argued that the dot before D is unnecessary, since D is a selection of the whole previous breeding program, but I prefer it as is. Notice that the breeder found no reason to indicate a particular selection of 22/23. The system is very flexible.

Since I have been concerned with inbreeding to produce uniform amaryllis strains and vigorous F:1 hybrids, I have selfed many bulbs and crossed many siblings. For brevity, the selfed offspring of plant N is labeled N' rather than N/N. As an example, the 92 red inbred strain has been selfed for four generations, giving such seedlings as 92''''C, rather than 92/92·A//92/92·A·B///92/92·A//92/92·A·B·C//// 92/92·A//92/92·A·B///92/92·A//92·A·B·C. The last expression is more exact, and it is still much shorter than a verbal description of the history of the strain, but since only a very few of any selfed generation are retained for further breeding, 92''''X usually is sufficient.

Similarly, sibling crosses are often designated as 92^{v} rather than 92A/92B.

The code requires a little thought at first, but I have found the benefits to be enormous. After a little practice, the system becomes automatic in practice.

A few examples might be interesting. The named clone "Big Tex" has the following formula: F'^{v}'B/ATH'^{v}A·A, where F="Fire Dance" and ATH="Athos." F was inbred for three generations and ATH for two generations before the cross was made to produce the 12-inch beauty, "Big Tex," which is now being propagated by cuttage.

For another example, the 10-inch orange clone "Great Pumpkin" is TORO/AUL'·A//TORO'B·A'A///TRI'A, where TORO="El Toro," AUL=*A. aulica*, and TRI="Golden Triumphator." Both the TORO-AUL strain and the TRI strain are being inbred much further to try to obtain uniform "Great Pumpkin" types from seeds. Results are very promising.

BREEDING FOR FRAGRANCE IN HYBRID **AMARYLLIS**

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Purpose: Fragrance, a feature of some species of Amaryllis is not usually found in commercially available hybrids. This report is about the attempt to add this trait to existing lines of hybrid Amaryllis.

Material: Dutch hybrid bulbs (both named and seeding) were obtained from Ludwig, Van Meeuwen & Hadco sources. None of these bulbs were fragrant—they were of both regular and Gracilis types. These were augmented with Senorita and Gracilis bulbs furnished by the kindness of C. D. Cothran of California.

These bulbs were flowered from March through June of 1975. Some were kept in my residence, others in the greenhouse. No record was kept of the exact location or culture of the individual bulbs.

Pollen was supplied by the cooperation of J. L. Doran of California. It was collected in gelatine capsules and sent to Oregon by mail—being en route up to four days. Three different lots were received.

Upon receipt, the capsules were stored in a household type refrigerator—the jar was removed only while the contents were being used. The capsules were nested in cotton batting placed over ¼ cup of granules of Drierite (Drierite: Anhydrous Ca SO_4; W. H. Hammond Co., Xenia, Ohio). All were contained in a screwtop glass jar—one pint capacity.

Method: The first day a flower opened, the stamens were removed. The second day, pollen was applied with a small brush. This was repeated every other day while the flower remained crisp.

Pollen used was obtained from two white trumpet clones. P2—Doran's #60, collected in 1968 in Brazil. Similar to A. elegans but tube length, shorter, heavily perfumed. P3—A. fragrentissima, a very sweet trumpet from Bolivia.

Table of results is given below. Some pods (labeled aborted) grew for about three weeks, then turned yellow and died. Tiny white seeds could be detected inside.

TABLE 1. Breeding for fragrance in hybrid Amaryllis

Pollen	Clone Source	Type	Flowers Pollenated	Aborted Pods	Mature Pods	Notes
P2	Ludwig	Marie Goretti, white	2	0	0	
P2	Ludwig	pink seedling	2	0	0	
P2	Ludwig	orange seedling	2	1	1	(1)
P2	Ludwig	Gracilis - Rubina	2	0	0	
P2	Ludwig	Gracilis - Firefly	2	2	0	
P3	Ludwig	Gracilis - Picture	2	1	1	(2)
P3	Ludwig	Gypsy Giant	1	0	1	(3)
P3	Ludwig	Gracilis - Carina	2	1	1	(4)
P3	Ludwig	Goliath, red	2	0	0	
P3	Ludwig	Marie Goretti, white	2	0	1	
P3	Ludwig	white seedling A	4	4	0	
P3	Ludwig	white seedling B	3	3	0	
P3	Ludwig	pink seedling	2	0	0	
P3	Ludwig	striped seedling	2	0	0	
P3	Cothran	Senorita	1	0	1	(5)
P3	Cothran	Gracilis, red	2	0	0	
P3	Hadco	white seedling	2	0	0	
P3	Van Meeuwen	Gracilis, white A	2	0	0	
P3	Van Meeuwen	Gracilis, white B	2	0	0	

(1) 5 tiny seeds - no germination. (2) 1 small seed - no germination. (3) 26 seeds, 20 germinated. (4) 30 seeds, 21 germinated. (5) 4 small seeds - no germination.

Remarks: Seed production and germination, while low, is possible with some crosses. Approximately 30 seedlings are now being grown. It is hoped that more crosses can be made in the 1976 season. If clones of known fragrance could be obtained, it would greatly facilitate the project.

ORIGINS OF THREE TEXAS SPECIES OF **ZEPHYRANTHES**[1]

R. O. FLAGG AND W. S. FLORY

Carolina Biological Supply Co. and Wake Forest University

The purpose of this paper is to submit and to examine evidence indicating that three quite fertile "species" arose as natural hybrids between *Cooperia* (*Zephyranthes* Subgenus *Cooperia* (Herb.) Traub) and *Zephyranthes* (Amaryllidaceae). These putative parental taxa, often regarded as generically distinct, are here both considered as subgenera of *Zephyranthes*. The three derivatives are *Zephyranthes (Cooperia) smallii* (Alex.) Traub, *Z. (Cooperia) jonesii* (Cory) Traub, and *Z. (Zephyranthes) refugiensis* Jones. Each was described in comparatively recent years: in 1939, 1950 and 1961, respectively. All three quite apparently resulted from hybridization involving *Z. (Zephyranthes) puchella* J. G. Smith and *Z. (Cooperia) herbertiana* D. Dietr.

MATERIALS AND METHODS

Distributional and ecological data are chiefly composites of information obtained on collecting trips in October, 1954, and October, 1960, supplemented by examination of specimens in various herbaria: (abbreviations according to Holmgren and Keuken, 1974) ARIZ, C, F, GH, KANU, MISSA, MO, NO, NY, RUNYON, SMU, TEX, TRA, UARK, UC, US, and WWF.

The Royal Horticultural Society Colour Chart was used in color determinations.

Gross morphological data from the Texas coastal bend complex were secured primarily as accessions were collected from native habitats. Some taxa, however, were removed from their natural habitats with data being taken as the plants grew at The Blandy Experimental Farm at Boyce, Virginia. The data cannot be regarded as strictly random as efforts were often made to obtain as many variants as possible. Leaf widths were recorded from the broadest, usually basal, part of the largest leaves. Perianth segments were removed from the flowers to facilitate consistent measuring of lengths of filaments and perianth tubes. The free filaments of *Zephyranthes* species are usually in two alternate sets with respect to length; lengths of the free portions of sepaline filaments were recorded in this study.

Methods of cytological study of root-tip divisions were the same as those employed in previous studies (Flory and Flagg, 1958; Flagg, 1961a). Voucher specimens are deposited in the National Herbarium. In species of *Zephyranthes* meiosis occurs while the bud and scape are

[1] Investigation supported by N.S.F. Grants G-2716 and G11080 to W. S. Flory. Much of this work was done at The Blandy Experimental Farm of the University of Virginia.

within the bulb and less than 1.5 cm long. As the supply of bulbs of known somatic chromosome numbers was insufficient for wholesale sacrificing, the technique described by Varma (1960) was tried. Although the limited number of bulbs curtailed meiotic studies, certain patterns of floral bud locations became apparent (Fig. 19-3) and were recorded from a minimum of ten bulbs each of *Z. pulchella, Z. refugiensis, Z. smallii, Z. herbertiana,* and *Z. traubii.* Three bulbs of *Z. jonesii* were dissected.

Percentages of aborted pollen were determined from random counts of 500 or more grains from each accession examined, except where stated in the case of *Z. traubii.*

Buds to be pollinated were emasculated one or two days before normal opening and then covered. In a number of control tests run at different times, the ovules did not develop without pollination.

RESULTS AND OBSERVATIONS

1. Distributional and Ecological Relationships

The range of *Z. herbertiana* extends from southern Kansas to Oaxaca, Mexico, and from New Mexico and western Texas to eastern Texas and Louisiana. *Z. pulchella* is apparently restricted to the Texas coastal plain. Although *Z. herbertiana* is found in a variety of habitats, it seems generally better suited to drier conditions than those of the low fields and roadside ditches profusely occupied by *Z. pulchella.*

Zephyranthes smallii is only known to occur in and near Brownsville, Texas, primarily in low fields which may be flooded after heavy rains. *Zephyranthes jonesii* is ecologically similar to *Z. smallii* but is found (Fig. 19-1) about 125 miles to the north, distributed over about 2000 square miles in an area extending northward from Corpus Christi to within about 10 miles of Victoria. *Zephyranthes refugiensis,* also found in swales, is contained within the area occupied by *Z. jonesii* and ranges over perhaps 200 square miles (Fig. 19-1). Often *Z. jonesii* and occasionally *Z. refugiensis* thrive in slightly elevated areas that are outside the ecological niche of *Z. pulchella.*

The known distribution of *Z. traubii* is narrow. The few existing herbarium sheets of this taxon indicate that it ranges along the Texas Gulf Coast from Galveston Bay south into Victoria and Calhoun Counties. Our collections extend its southern range into the northern part of Refugio County. Where collected, it has been restricted to low but well drained grasslands.

The several taxa studied here have their chief flowering periods, in native habitats, following heavy autumn rains. At such times *Z. pulchella, Z. smallii* and *Z. herbertiana* bloom side by side in the Brownsville area. Various groupings of *Z. pulchella, Z. refugiensis, Z. jonesii* and *Z. herbertiana* occur and flower together in the Texas coastal bend area (Fig. 19-1). At least one pasture in Refugio County (21.3 miles north of Refugio, on the eastern side of US 77) was found to be shared by *Z. refugiensis, Z. jonesii* and *Z. traubii.*

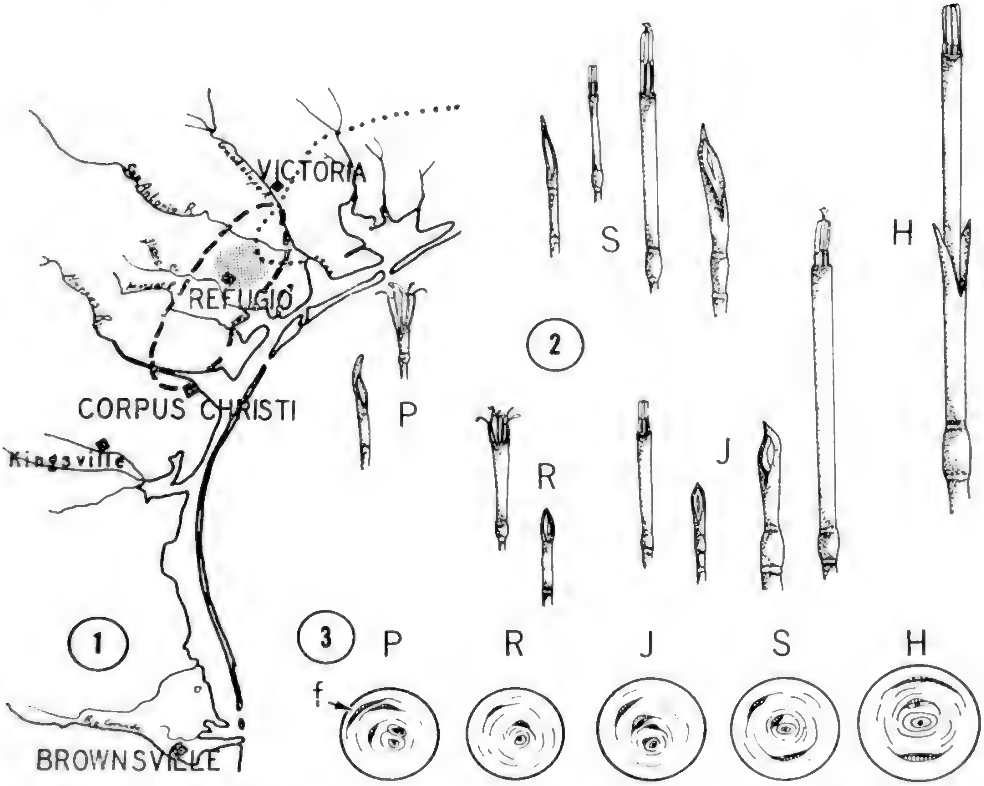

Fig. 19. **(1)** Map of the lower gulf coastal area of Texas showing distributions of **Zephyranthes refugiensis (stippled), Z. jonesii (within broken line)**, and **Z. smallii (Brownsville).** The southern range of **Z. traubii** is indicated by the **dotted line. Z. pulchella** and **Z. herbertiana** are sympatric throughout the whole area shown. **(2)** Sketches of flowers with perianth segments removed; the spathes of all but **Zephyranthes herbertiana** are shown separately from the flowers. **(S)—Z. smallii; (P)—Z. pulchella; (R)—Z. refugiensis; (J)—Z. jonesii; (H)—Z. herbertiana.** (3) Diagrams of bulbs in horizontal cross sections showing patterns of bud arrangement. **f**—floral scale (size somewhat exaggerated for clarity).

Two other members of the tribe Zephyrantheae occur on the Texas coastal plains: *Z. (Cooperia) drummondii* and *Habranthus andersonii* var. *texanus.* Neither of these share habitats with the taxa under consideration. The morphology of the *Habranthus* species is strikingly different from any of the involved taxa. *Zephyranthes drummondii* flowers in the spring.

2. Morphological and Physiological Characters

Data on several pertinent morphological and physiological characters (as many as seems practical) are presented in Table 1, and in Figures 19-2 & 3; 20-4 & 5, and 21-6.

The variation in size and form of perianth of both *Z. smallii* and *Z. jonesii* is much greater than is that of either *Z. pulchella* or *Z. herbertiana.*

Shortly pedicellate forms of *Z. herbertiana,* like that diagrammed in Fig. 20-4 are also known to occur in Oklahoma where there is no other native species of *Zephyranthes,* in several widely separated counties of Texas, and in the state of San Luis Potosi, Mexico.

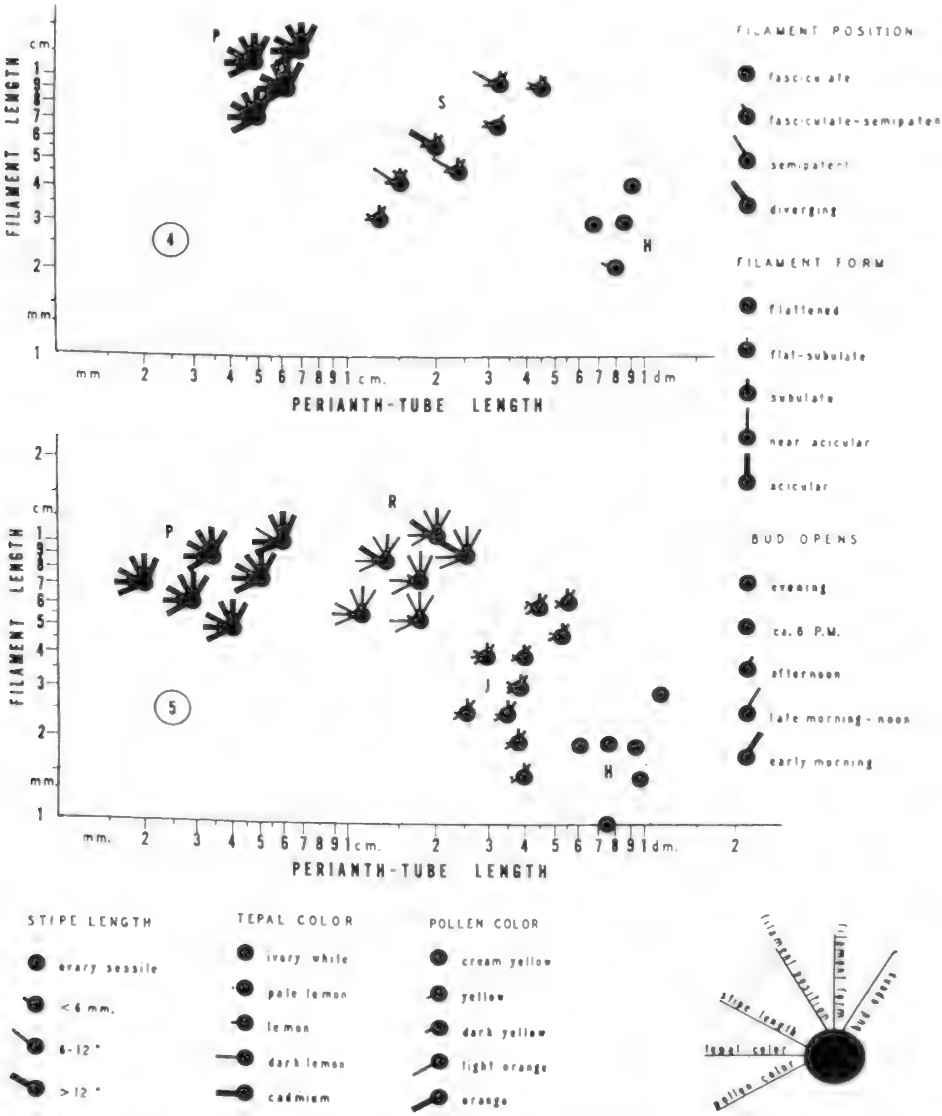

Fig. 20. For caption see following page.

Fig. 20. Pictorialized scatter diagrams (4) and (5) using 8 characters and log-scales to depict **Zephyranthes pulchella (P), Z. smallii (S), Z. refugiensis (R), Z. jonesii (J)** and **Z. herbertiana (H). Fig. 20-4.** Representatives of populations from Brownsville, Texas. **Fig. 20-5.** Representatives of populations from the Texas coastal bend area. The **direction** of the lines radiating from the glyphs designates the character concerned. Beginning with the line to the lowest left of a glyph (at about "8 o'clock") the character of pollen color is represented. Then clockwise the next 2 lines above represent tepal color and stipe length respectively. Still going clockwise, the upward pointing lines in order (left to right) represent filament position, filament form and time of anthesis. Variations in the characters are denoted by length and width of the lines radiating from the several glyphs—each of which represents an individual plant. Symbolized character descriptions follow. **Filament Position:** fasciculate, solid circle; fasciculate-semipatent, short line; semipatent, long narrow line; diverging, long broad line. **Filament Forum:** flattened, solid circle; flat-subulate, dot; subulate short line; near acicular, long narrow line; acicular, long broad line. **Time of Anthesis:** evening, solid circle; ca. 6 PM, dot; afternoon, short line; late morning to noon, long narrow line; early morning, long broad line. **Pollen Color:** cream yellow, solid circle; yellow, dot; dark yellow, short line; light orange, long narrow line; orange, long broad line. **Tepal Color:** ivory white, solid circle; pale lemon, dot; lemon, short line; dark lemon, long narrow line; cadmium, long broad line. **Stipe Length:** ovary sessile, solid circle; less than 6 mm, short line; 6 to 12 mm, long narrow line; more than 12 mm, long broad line.

3. Chromosomes

Numbers—The chromosome numbers determined for various accessions from the Texas coastal plains are presented in Table 2. As we are dealing with two spatially separate complexes, the taxa from the coastal bend are separated, in Table 2, from those of the Brownsville area.

In the Brownsville area *Z. pulchella* has 2n=48, the predominant form of *Z. smallii* has 2n=54, and the predominant form of *Z. herbertiana* has 2n=60.

Within the distribution of *Z. jonesii, Z. pulchella* has 2n=48, and the predominant forms of *Z. refugiensis, Z. jonesii,* and *Z. herbertiana* have 2n=48.

Two plants, T-45-T-13 and T-45-T-11, closely resembling and initially classified as *Z. traubii*, have 2n=48 and 2n=72, respectively. These came from a pasture in the northern part of Refugio County, where they were associated with *Z. refugiensis, Z. jonesii* and *Z. traubii* (Fig. 21-6).

Distinctive chromosomes—In general the chromosome complements of the various taxa are quite similar in appearance. There are, however, certain distinctive chromosomes in at least five of the "species" (Fig. 22-7). Certain of these occur in one or more of the recently described taxa, as well as in either *Z. pulchella* or *Z. herbertiana*, or in both of these.

Zephyranthes traubii shows no chromosome of singular distinctiveness. It does possess a satellited chromosome similar in size to chromosome number 2 in Figure 22-7.

4. **Fertility**

Seed sets.—An abundance of viable seed is generally produced by *Z. pulchella, Z. refugiensis, Z. smallii, Z. jonesii,* and *Z. herbertiana.* Data on production of seed have not been obtained for *Z. traubii,* or for several apparent hybrids between *Z. traubii* and *Z. jonesii.* The artificial hybrids (2n=72) obtained by F. B. Jones (1957) from the cross *Z. drummondii* ♀ x *Z. pulchella* ♂ readily produce viable seeds. Likewise our hybrid (No. F5A, 2n=88-89) of *Z. smallii* ♀ x *Z. brasiliensis* (Traub) *Traub* ♂ (2n=70) sets full capsules of viable seeds.

Pollen abortion.—Approximate abortion of pollen encountered from random sampling in the Brownsville area (number of samples in parentheses) was: *Z. pulchella* (4) 1%; *Z. smallii* (4) 3-5% and *Z. herbertiana* (3) 4-6%. Random sampling of the coastal bend taxa gave these results: *Z. pulchella* (4) 11-42%; *Z. refugiensis* (4) 5-30%; *Z. jonesii* (4) 13-26%; T-45-T13 (an apparent hybrid near *Z. traubii*) (1) 67%; *Z. herbertiana* (3) 2-8%; and *Z. traubii* (1 sample of 60 grains) 6%. Jones' (1957) *Z. drummondii* x *Z. pulchella* hybrids showed 8% aborted pollen.

Considerable variation in the size of both aborted and normal appearing pollen was observed for *Z. smallii, Z. jonesii,* and *Z. herbertiana.* Some of the intermediates between *Z. jonesii* and *Z. traubii* are apparently hybrids between these two. This is especially true of those represented by the solid glyphs nearest T.

Variation in size of grains was apparent in samples of pollen of *Z. refugiensis* and also in that of *Z. pulchella* from the coastal bend area.

5. **Crossing Trials**

The results of a number of attempted hybridizations between *Zephyranthes* and *Cooperia* representatives are presented in Table 3.

Of 63 attempts 17, about 27 per cent, produced seed. While comparatively large populations of progeny are available, the great majority of the resulting seedlings were still immature at the time of this study. It seems significant that approximately the same success followed pollinations between *Zephyranthes* and *Cooperia* (25%) as from cross pollinations within *Cooperia* (30%).

Table 1. Data on several characters of fall-flowering **Zephyranthes** species from the Texas coastal plains (based on 30 flowers of **Z. traubii**, and on 60 or more flowers of each of the other species). Measurements are in **millimeters**.

Character	pulchella	refugiensis	jonesii	smallii	herbertiana	traubii
	Species					
Ovary length	2.5-5	4.5-7	5-8	4-8	6-12	5-6
Spathe length	17-28	19-32	21-40	24-46	35-70	35-40
Spathe tube length	3-11	4-15	11-23	15-30	22-45	25-29
Maximum leaf length	370	*	*	500	600	*
Maximum leaf width	3.5	4	4.5	5	5	3
Leaf arrangement	radial	radial	radial	mostly radial	bilateral	bilateral
Primrose odor	none	infrequent	great	great	great	great
Green color in perianth tube	great	much	some or little	some	little	little

* Not sufficiently long under standard cultivation for valid measurements.

Table 2. Chromosome numbers of collections of fall-flowering **Zephyranthes** from two different areas of the Texas coastal plain.

Taxon	2n	Accession	County	Collector and no.
		Rio Grande Lower Valley		
Z. pulchella	48	14160-57-1	Cameron	**Clint T-55**
Z. pulchella	48	15054-52	Cameron	**Traub 3511a**
Z. pulchella	48	15044-61	Cameron	**Flagg T-55-P**
Z. smallii	53	13175-54-3	Cameron	**Flory**
Z. smallii	54	13175-54-1	Cameron	**Flory**
Z. smallii	54	13175-54-2	Cameron	**Flory**
Z. smallii	54	14169-57-1	Cameron	**Clint**
Z. smallii	58	13070-52	Cameron	**Clint T-40**
Z. smallii	70	14169-57-2	Cameron	**Clint**
Z. smallii "major"	72	13076-52	Cameron	**Clint T-56**
Z. herbertiana	60	14174-57	Cameron	**Clint 1021**
Z. herbertiana	60	14173-57	Cameron	**Clint 1030**
Z. herbertiana	60	15411-61	Cameron	**Clint 2951A**
Z. herbertiana	68	*13066-52	Cameron	**Clint T-24**
Z. herbertiana	72	*13065-52	Cameron	**Clint T-23**
		Coastal Bend		
Z. pulchella	48	15039-61	Goliad	**Flagg T-52-P**
Z. pulchella	48	15040-61-1	Refugio	**Flagg T-53-P1**
Z. pulchella	48	14446-59	Victoria	**Jones**
Z. refugiensis	46	13245-54	Refugio	**Jones**
Z. refugiensis	48	15007-61-1	Refugio	**Flagg T-34-R1**
Z. refugiensis	48	15025-61-1	Refugio	**Flagg T-45-R1**
Z. refugiensis	48	15035-61-1	Refugio	**Flagg T-51-R1**
Z. refugiensis	48	15041-61-5	Refugio	**Flagg T-53-R5**
Z. jonesii	48	15024-61-1	Refugio	**Flagg T-45-J1**
Z. jonesii	48	15024-61-7	Refugio	**Flagg T-45-J7**
Z. jonesii	48	15024-61-8	Refugio	**Flagg T-45-J8**
Z. jonesii	48	15003-61-1	San Patricio	**Flagg T-33-J1**
Z. jonesii	72	14965-61	(?)	(Traub)
Z. herbertiana	48	15051-61	(?)	**Jones 4352A**
Z. herbertiana	48	15004-61	San Patricio	**Flagg T-33-D**
Z. herbertiana	48	14995-61	Nueces	**Flagg T-30-D**
Z. herbertiana	48	15031-61	Victoria	**Flagg T-49-D**
Z. herbertiana	48	*14445-59	Aransas	**Jones**
Z. herbertiana	ca. 60	*14443-59	Aransas	**Jones**
Z. traubii	24	15026-61-2	Refugio	**Flagg-T-45-T2**
Z. traubii	24	15026-61-4	Refugio	**Flagg-T-45-T4**
Z. traubii	24	*15029-61-4	Victoria	**Flagg T-47-T4**
Z. traubii	(n=12)	15034-61	Victoria	**Flagg T-50**
unnamed: T-45-T13	48	15026-61-13	Refugio	**Flagg T-45-T13**
unnamed: T-45-T11	72	15026-61-11	Refugio	**Flagg T-45-T11**

* **Several miles outside of the ranges of Z. smallii or of Z. refugiensis and Z. jonesii.**

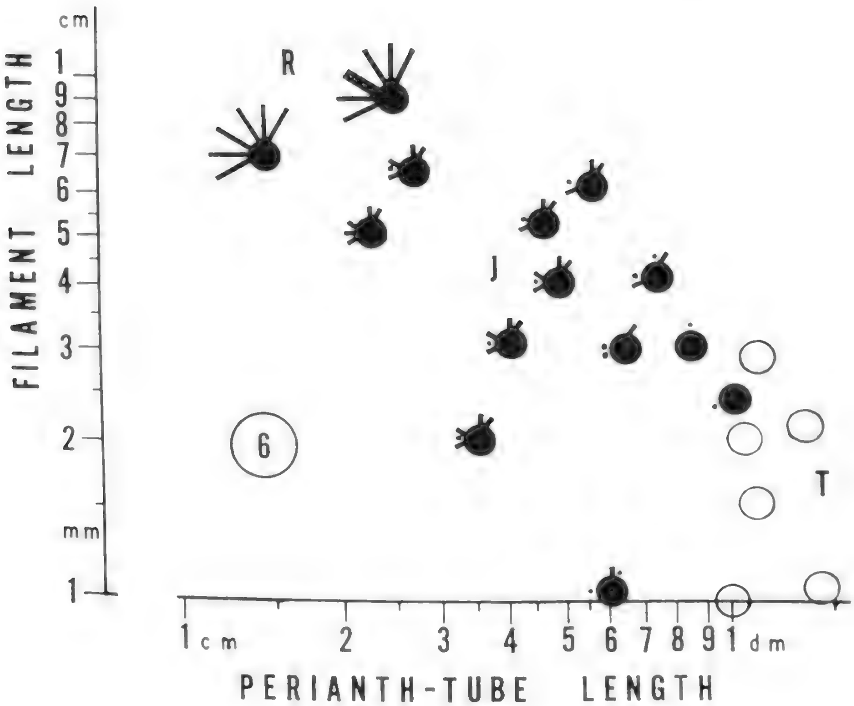

Fig. 21. Pictorialized scatter diagram (6) of representatives of populations of **Zephyranthes** from a pasture in northern Refugio County, Texas (Flagg collection T-45). **Z. traubii (T)** plants are symbolized by open circles; other symbols are as described with legend for **Fig. 20-(4)** and **(5)**.

DISCUSSION AND CONCLUSIONS

1. Origin of Zephyranthes (Cooperia) smallii

In the original description of *Z. smallii,* Alexander (1939) noted an anonymous suggestion that the yellow color of the new *Cooperia* may have come from a yellow-flowered *Zephyranthes.* Apparently considering flower color alone, he rejected the suggestion as "unnecessarily far-fetched."

While resembling *Z. herbertiana* in odor, pollen color and leaf width, *Z. smallii* is intermediate between *Z. pulchella* and *Z. herbertiana* not only in flower color but in leaf length and arrangement, position of floral buds in the bulb, time of bud expansion, and staminal characters as well as in the lengths of the pedicel, spathe, spathe tube, ovary, and perianth tube (Table 1; Figs. 19-2 and -3, 20-4). An intermediate position *per se* does not necessarily indicate hybrid origin. How-

Table 3. Results of cross-pollinations between **Zephyranthes** and **Cooperia** representatives.

Seed parent	Pollen parent	No. of attempts	No. of capsules	Offspring
	Pollinations between **Zephyranthes** and **Cooperia**			
Z. pulchella	**Z. (C.) herbertiana**	11	1	yes
Z. pulchella	**Z. (C.) smallii**	1	0	none
Z. refugiensis	**Z. (C.) drummondii**	1	1	yes
Z. (C.) herbertiana	**Z. pulchella**	21	3	yes
Z. (C.) herbertiana	**Z. refugiensis**	1	0	none
Z. (C.) drummondii	**Z. refugiensis**	1	1	yes
Z. (C.) smallii	**Z. pulchella**	3	2	yes
Z. (C.) smallii	**Z. refugiensis**	1	0	none
Z. (C.) smallii	**Z. x Ajax**	3	3	maternals
	Cross-pollinations within **Cooperia**			
Z. (C.) herbertiana	**Z. (C.) jonesii**	3	0	none
Z. (C.) herbertiana	**Z. (C.) smallii**	4	1	maternals
Z. (C.) jonesii	**Z. (C.) smallii**	1	1	yes
Z. (C.) smallii	**Z. (C.) brasiliensis**	2	1	hybrids and maternals
Z. (C.) smallii	**Z. (C.) herbertiana**	5	0	none
Z. (C.) smallii	**Z. (C.) jonesii**	1	0	none
Z. (C.) smallii	**Z. (C.) drummondii**	4	3	yes

ever, when the variability, ecology, distribution, season of flowering, and cytology of *Z. smallii* are also taken into account, it becomes evident that *Z. (Cooperia) smallii* is a hybrid between *Z. pulchella* and *Z. (Cooperia) herbertiana.*

Percy-Lancaster (1913, 1922, 1936) reported several artificial hybrids under the name "Cooperanthes" *(Cooperia* x *Zephyranthes).* From his descriptions (loc. cit.), and admitted lack of pollination control (1936), it is impossible to tell which species were parents of any given hybrid. This is true, at least, of those hybrids currently available. Percy-Lancaster's "Cooperanthes," however, obviously demonstrate hybridization between *Cooperia* and *Zephyranthes.* The high fertility in the artificial hybrids *(Z. (Cooperia) drummondii* x *Z. pulchella*) obtained by F. B. Jones (1957) indicates that crossing barriers between *Cooperia* and *Zephyranthes* are not greater than those normally occurring between the species of a single genus. The data in Table 3 lend support to such a conclusion.

The predominant form of *Z. smallii* (2n=54) apparently arose as a hybrid between *Z. pulchella* (2n=48) and the *Z. herbertiana* clone with 60 somatic chromosomes which occurs in the same Brownsville area (Fig. 22-8). Further support of the hybridity of *Z. smallii* is furnished by comparing chromosome complements. The complement of *Z. smallii* may be distinguished from that of *Z. herbertiana* by the presence of one submetacentric chromosome with a satellite on the long arm, such as occurs in *Z. pulchella* (Fig. 22-7).

The derivation of the 72-chromosome *Z. smallii* is less clear but its origin may be postulated as having occurred (1) by the union of reduced and unreduced gametes of 48-chromosome races of *Z. pulchella* and *Z. herbertiana* (2n=48), or more directly (2) from the 54-chromosome *Z. smallii* by union of gametes with unusual numbers. Variation in the size of aborted and non-aborted pollen grains suggests (Darling-

ton, 1965; Sharp, 1934) frequent meiotic irregularities in both *Z. smallii* and *Z. herbertiana*. Such irregularities were observed in *Z. drummondii* by Coe (1953).

2. Origins of *Z.* (*Cooperia*) *jonesii* and *Z. refugiensis*

The morphological and ecological reasons for considering *Z. (Cooperia) jonesii* a hybrid between *Z. pulchella* and *Z. (Cooperia) herbertiana* (Figs. 19-2 & 3, and 20-5; Table 1) are essentially the same as those presented in the case of *Z. smallii*. Two primary differences in the putative crosses are that they occurred in different localities (Fig. 19-1) and with different chromosome races of *Z. herbertiana* being involved (Table 2; Fig. 22-8). The 48-chromosome *Z. jonesii* probably arose from the union of gametes of 48-chromosome plants of *Z. pulchella* and *Z. herbertiana* (Fig. 22-8).

Derivation of the 72-chromosome *Z. jonesii* may be explained as resulting from the union of reduced and unreduced gametes with (1) a direct origin by self-fertilization in the 48-chromosome taxon; or with the gametes tracing from 48-chromosome plants in (2) a separate cross of *Z. pulchella* and *Z. herbertiana;* or, (3) a back-cross of *Z. jonesii* to *Z. herbertiana*. The first suggestion seems the most likely since the higher chromosome form of *Z. jonesii* has the appearance of an enlarged 48-chromosome one.

The intermediate position of *Z. refugiensis* between *Z. pulchella* and *Z. jonesii* is quite obvious (Figs. 19-2 & 3 and 20-5; Table 1). Considering its morphological intermediacy and variability, along with its ecology, distribution (Fig. 19-1), cytology (Table 2; Fig. 22-7), and blooming season, *Z. refugiensis* (2n=48) may logically be regarded as resulting from a back-cross of *Z. jonesii* (2n=48) with its yellow-flowered parent *Z. pulchella* (2n=48) (Fig. 22-8). The less likely possibility that *Z. refugiensis* might have resulted from a direct cross between *Z. pulchella* and *Z. herbertiana* should probably not be ruled out. In any case, the wider distribution of *Z. jonesii* suggests that it antedates *Z. refugiensis*.

The 46-chromosome *Z. refugiensis* appears to be a direct derivative of the 48-chromosome one, although it could be the result of a separate back-cross of *Z. jonesii* with *Z. pulchella*.

Three types of distinctive chromosomes (Fig. 22-7) are shared by *Z. refugiensis* and *Z. jonesii* and *Z. herbertiana*. The distinctive type of chromosome (number 4 in Fig. 22-7) found so far only in *Z. refugiensis* and *Z. jonesii* indicates their cytological relationship. The absence of chromosome 4 (Fig. 22-7) from the somatic complements of the examined accessions of *Z. pulchella* and *Z. herbertiana* does not exclude the latter two species as probable parents. The distinctive chromosome type common to *Z. refugiensis* and *Z. jonesii* could have arisen *de novo* in the original cross. However, variability of chromosome morphology within species in the tribe Zephyrantheae is well known (Coe, 1953, 1954; Flagg, 1961b). Furthermore, relatively few of the possible parental lines in *Z. pulchella* and *Z. herbertiana* have been examined cytologically.

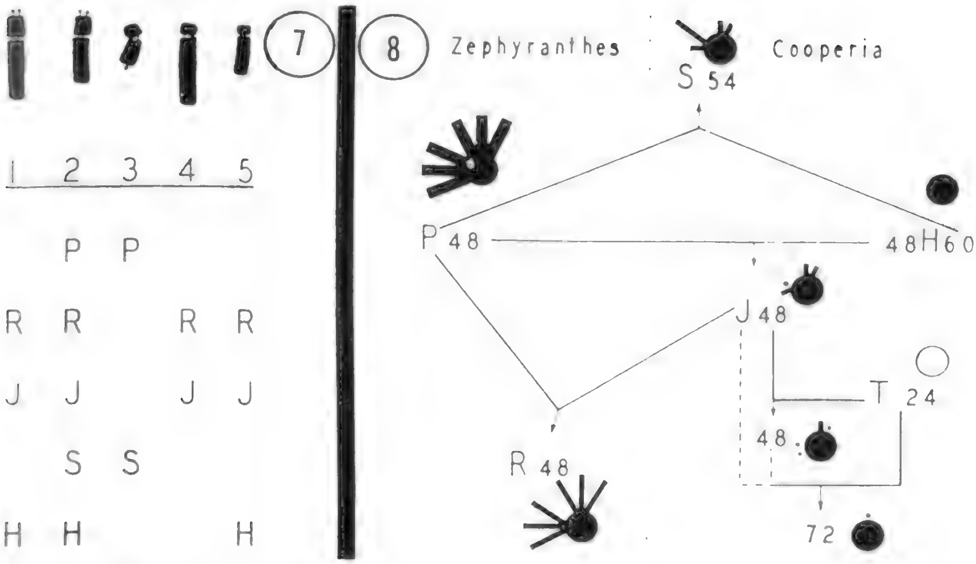

Fig. 22. A tabular comparison (7) of the occurence of five distinctive types of chromosomes in **Zephyranthes pulchella (P), Z. refugiensis (R), Z. jonesii (J), Z. smallii (S)** and **Z. herbertiana (H)**. Diagram (8) showing the putative origins of the three recently described yellow-flowered, fall-blooming **Zephyranthes** of the Texas coastal plain. Numerals indicate somatic chromosome numbers. Letters and glyphs have the same meaning as in **Figs. 20,** and **21.**

3. Some Related Hybrids

In general distribution, in ecology, and in season of flowering, *Z. traubii* overlaps *Z. refugiensis, Z. jonesii* and *Z. herbertiana.* No location has been observed where *Z. herbertiana* and *Z. traubii* share the same habitat. The latter, however, is known to occur with *Z. jonesii* and *Z. refugiensis* in at least one location in the northern end of Refugio County (Fig. 19-1). Some apparent hybrids (T-45-T13; T-45-T11) taken from that pasture, with somatic complements of 48 and 72 chromosomes respectively, are closer to *Z. traubii* (2n=24) in appearance than they are to any other named taxon. Their morphological distinctions from *Z. traubii* are small and include such characters as flat-subulate rather than flat-rectangular filaments, slightly shorter perianth tubes (Fig. 21-6), and perianths of somewhat smaller diameter. The significance of these differences was not realized until a cytological survey revealed the higher chromosome numbers present in these plants. There is little doubt that these are hybrids between *Z. jonesii* and *Z. traubii.* The origins of such 48- and 72-chromosome hybrids may be explained in a number of ways involving unions of reduced and unreduced gametes, or by the doubling of zygotes combining reduced gametes (Fig. 22-8).

The reflexed perianth-segments and the exserted stigmas of the larger forms of *Z. jonesii* might suggest that *Z. traubii* was one of the antecedents of the former. However, the larger forms of *Z. smallii* in and around Brownsville also have reflexed perianth-segments and exserted stigmas even though they arose nearly 200 miles from the distributional area of *Z. traubii* (Fig. 19-1).

Unlike *Z. herbertiana* of the coastal bend and Brownsville areas, *Z. traubii* has not been found in close association with *Z. pulchella*. Distributions (Fig. 19-1) and ecology would indicate that *Z. jonesii* and *Z. refugiensis* migrated into the range and habitat of *Z. traubii* rather than from it. Further, the percentage of aborted pollen (67%) found in T-45-T13 might indicate pronounced cytological differences between *Z. jonesii* and *Z. traubii*.

4. "Specific" Boundaries

Zephyranthes pulchella and *Z. herbertiana* have apparently hybridized under natural conditions on at least two occasions. The wide phenotypic differences between the parental species, associated with heterogeneity and polyploidy of each, has resulted in their natural hybrids being quite diverse. In spite of variability, any two of the taxa, *Z. pulchella, Z. refugiensis, Z. smallii, Z. jonesii* and *Z. herbertiana*, are at least as easily distinguished from each other as are many generally recognized species of *Zephyranthes*. "Specific" boundaries of these five taxa are apparently sustained by polyploidy, apomixis, and strong tendencies toward self- and "intraspecific" fertilization.

Pollen is shed before or shortly after flora expansion. In general, the stigma is below or among the anthers. Plants with greatly exserted stigmas make up minor parts of populations of *Z. jonesii*. The same is sometimes true in *Z. smallii* and *Z. herbertiana*. In these three cooperias some forms with shortly exserted stigmas occur; usually elongation of the style after floral expansion forces the stigma through the fasciculate anthers and self-pollination is automatic. Copious seed production indicates that self-pollination in the five taxa leads to self-fertilization. This is supported by Coe's (1953) observation for *Z. (Cooperia) drummondii* that "in unfertilized ovules . . . the ovule degenerates before maturity." We have never seen seed develop in members of the tribe Zephyrantheae when pollinations were prevented.

The fragrance of the cooperias, as well as flower conspicuousness and concurrent flowering seasons would apparently encourage the activities of insects with respect to cross-pollination. However, differences in the time of day of floral expansion may act as a counterbalance so that cross-pollination would tend to be "intraspecific" rather than "interspecific."

Parthenogenesis has been known in the tribe Zephyrantheae for some time (Pace, 1913; Flory, 1939). From results of cytological and embryological studies, Coe (1953) reported that *Z. drummondii* and *Z. herbertiana* are apomicts. Our artificial hybrid (2n=88-89) between *Z. smallii* (2n=54) ♀ and *Z. brasiliensis* (2n=70) ♂ undoubtedly resulted from the fertilization of an unreduced egg. When to these

facts are added the maternal progenies of *Z. smallii,* the total is suggestive of *Z. smallii* being an apomict, also. Evidence is not available on the presence or absence of apomixis in *Z. pulchella, Z. refugiensis* and *Z. jonesii.*

SUMMARY

The white-flowered *Zephyranthes (Cooperia) herbertiana* and the yellow-flowered *Z. (Zephyranthes) pulchella* are both widely distributed over the Texas coastal plain. Evidence of several kinds indicates that different forms of these two taxa hybridized to produce the two yellow-flowered cooperias, *Z. smallii* and *Z. jonesii*, as well as the more recently described *Z. (Zephyranthes) refugiensis.*

Zephyranthes smallii originated in, and is yet restricted to, the Brownsville, Texas, area. Most plants of *Z. smallii* have 54 somatic chromosomes and quite evidently originated from a cross, or crosses, between *Z. pulchella* (2n=48) and the 60-chromosome race of *Z. herbertiana.*

Zephyranthes jonesii and *Z. refugiensis* arose about 125 miles farther north, on the Texas coastal bend. Both usually have 48 somatic chromosomes and trace from the typical *Z. herbertiana* (2n=48) and *Z. pulchella* (2n=48). *Zephyranthes refugiensis* (2n=48) is apparently a back-cross derivative of *Z. jonesii* with *Z. pulchella.*

All three derivatives are shown to be intermediate between the putative parents with respect to a number of different characters.

Data from additional hybrids, both controlled and putative natural ones, lend support to the general hypothesis. Results of this study not only point to the hybrid origins of three recently described taxa but also lend support to the inclusion of *Cooperia* in *Zephyranthes,* and indicate the evolution of a syngameon (Grant, 1957) of the fall-blooming *Zephyranthes* of the Texas coastal plains.

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ZEPHYRANTHES BREEDING

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Zephyranthes lend themselves to breeding experiments as freely as anyone might wish or expect. The basic colors found in the species are in shades of pink, yellow and white. There are a very few notable exceptions of course, but basically one must begin with the three basic colors. By crossing one color with another, we can expect a certain percent of new color combination, and/or lighter intermediate shades. The F-1 generation can be full of surprises, but the real color breaks follow in later generations.

I began my breeding program in the primary quest for new colors such as S. Percy Lancaster had done earlier in this century in India. My own breeding program began in 1952 after a new group of *Zephyranthes* collectors and enthusiasts such as Mrs. Morris Clint and Fred Jones had shared a lot of newly discovered material with me. My first major effort in starting my collection was helped by bulbs purchased from Wyndham Hayward. I bought a bulb or more of just about every kind he could spare. My collection at that time consisted of the usual "standard fare" of species for that period . . . *Z. citrina*, *Z. rosea*, *Z. candida*, *Z macrosiphon*, and a few Florida species that I could not flower in San Antonio at that time. Mrs. Clint was kind enough to send me a single bulb of *Z. Clintiae* . . . a rare gem, and

Fred Jones sent *Z. pulchella* and *Z. jonesii.* Dr. Traub benevolently sent seed of *Z. smallii* and *Z. brasiliensis.* Thus the subgenus *Cooperia* was included in two new yellow species that had never been used by earlier breeders such as Lancaster. To these I also grew two other old-time favorites of the subgenus *Cooperia* . . . *Z. herbertiana* (syn *C. drummondii,* Z. brazosensis) and *Z. drummondii* (syn. *C. pedunculata*). I also had a few *Habranthus,—H. texanus,* and *H. robustus,* but decided not to use *Habranthus* in my breeding program.

My first efforts were to obtain the old classic Cooperanthes hybrids of Mr. Lancaster in India. I thought I might save a lot of time and effort by starting with his hybrids and then begin infusing the "fresh blood" of the many newer species into them. The idea seemed to make sense as a time-saver. I wrote to Mr. Lancaster and discussed this with him, adding that I would particularly like to begin with his more unusual shades of salmon, apricot, orange, etc. . . . what he had termed his "sunset" colors. He promised to dig and send me a start of these and later wrote that he had shipped them and that they were on their way. Something must have gone wrong as they never arrived. To say that I was disappointed would be an understatement. I resolved then and there that I would go ahead anyway and begin from scratch in my own way. I had seen a few of Lancaster's hybrids that I had obtained through Wyndham Hayward, and while I thought they were very nice, there was an element missing in them that was hard to define. A lot of them had strong characters of *Z. drummondii (Cooperia pedunculata)* which gave them good size, but robbed them of the beauty found in the stamens and pistil. The reproductive organs of *Z. drummondii* are buried in the throat, and while it can add to the species' charm, it does not do so in its hybrids. Then there was the pollen color problem. Unlike the mainstream species in the *Zephyranthes,* most members of subgenus *Cooperia* have white or pale yellow pollen instead of the bright yellow, or orange-yellow pollen of the others. Pollen color enhances the overall beauty. I found I also preferred a long style with towering stigma to a short shubby one as this added gracefulness. I did not like the fact that most *Cooperia* did not hold up well in afternoon sun and heat like the other rain lilies did.

Thus I resolved to concentrate on the day flowering *Zephyranthes,* at least initially. I wanted a hybrid intermediate between the deep rose of *Z. rosea* and the bright yellow of *Z. citrina.* I envisioned some sort of orange or copper colored flower in my first attempt. I used *rosea* as a seed parent and got a variety of pink flowered hybrids. All attempts at using *citrina* as seed parent yielded only maternal plants, presumed to be parthenogenic. My two best F-1 hybrids were a deep rose of medium size and great vigor was dubbed 'Ruth Page'. A second seedling, 'Eubank', was a bit lighter in color with a whiter throat and lacked the vigor of 'Ruth Page'. Both proved fertile to the pollens of almost any Rain Lily. As I was hoping for a color intermediate between yellow and rose, I was initially disappointed with 'Ruth

Page', later to be given an Award of Merit, and classified as the first hybrid of *Z.* x *ruthiae* [citrina x rosea] as it failed to give me the color I sought. Perhaps I should have repeated the cross a few more times as years later the late Alex Korsakoff crossed *citrina* x *rosea* and got a very nice intermediate colored hybrid having both rose and yellow pigmentation overlapping in the same flower which he called 'Ellen Korsakoff'.

Having found that 'Ruth Page' was fertile I began using various pollens of all available yellow species on it, still determined to get the illusive orange flowers in the second generation. I used pollens from *Z. citrina, Z. pulchella,* and then decided to delve into the yellow flowered new members of the subgenus *Cooperia, Z. smallii* and *Z. jonesii.* This was a concession I thought, but I was not retracing the steps of S. Percy Lancaster. Thus I was still pioneering along a new path, which is what I was determined to maintain until I could study the fruits of my endeavors. To these four yellow Rain Lilies I also added a fifth member, an undescribed Mexican light yellow-fld species collected halfway between Valles and Tamazunchale on the Pan American Highway in 1953, and dubbed the "Valles Yellow", collection number 53-1.

All five species yielded hybrids on 'Ruth Page', and gave me a variety of distinctive hybrids.

Table 1.

'Ruth Page' x 53-1 sp. "Valles Yellow"—'Texas' Large light yellow veined pink
'Ruth Page' x **Z. smallii** var. **major**—'Kitty Clint' (large lt. yellow)
'Ruth Page' x **Z. smallii** var. **minor**—'Fireball' small burnt orange-red
'Ruth Page' x **Z. smallii** var. **minor**—'Isabella'- pink hybrid form of **Z. smallii**
'Ruth Page' x **Z. smallii** var. **major**--'Starfrost' pink form of **Z. smallii major**
'Ruth Page' x **Z. pulchella** 'Apricot Queen'—Clear apricot. Medium sized fls.
'Ruth Page' x **Z. citrina** 'Peachy'—small peach-pink fls. in abundance.
'Ruth Page' x **Z. smallii** var. **major** 'San Antone' copper with yellow throat.
'Ruth Page' x **Z. jonesii** var. **major**—'Betty Alvey' Salmon with yellow keel and throat orange-yellow pollen and form like **Z. jonesii.**

As will be seen, a variety of shades in the spectrum between yellow and rose came into being. Some had yellow only in the throats, some were keeled as well, and many had complete merging of the pink and yellow pigments. When these second generation crosses were in turn pollinated with other species and between themselves, many more interesting new shades erupted upon the scene and it would be impossible and impractical to list them all as they are endless.

Several new lessons were learned. All yellow species were "faders" save *Z. pulchella*, and this fast-fading tendency was passed onto the hybrids. *Z. citrina* is intermediate in its fading, and it is less noticeable than *Z. smallii*, *Z jonesii*, and the yellow species 53-1. But only *Z. pulchella* has real depth and intensity that holds up into late afternoon in hot summer sunshine. Hybrids of *Z. pulchella* held up wonderfully compared to the others in the afternoons, but they required considerably more water to shock them into flower and they normally began flowering later into the summer.

Hybrids of *Z. jonesii* likewise began late in the summer, and shared cultural problems somewhat like those of *Z. pulchella.* But the hardiest

and most free flowering hybrids came from *Z. smallii.* These were tough, could withstand extremes in temperature, droughts, and floods with impunity. They began flowering early and continued until late. The large flowered form has longer segments and thus are inclined to appear a bit more narrow-petaled in the hybrids and this is a fault, but by careful selective breeding in following generations it can be conquered. The small flowered form of *Z. smallii* has broader more rounded petals in its offspring but the flowers are smaller. The important thing about *smallii* hybrids is their remarkable vigor and free flowering habits. Thus the trio of *rosea, citrina* and *smallii* formed the cornerstones for my hybrids. To these were added other species from time to time, but every species had at least one if not two of the above trio in its ancestry.

In the third and fourth generations new colors sprang forth, such as deeper and richer orange-copper hues, deep shades of red, and interesting pastel shades and combinations. First there were bicolors, then tricolors and eventually quadricolors. Because of *Cooperia* subgenus parentage many flowers remained opened both day and night. Normally members in the subgenus *Cooperia* open in the afternoon or evening and are mostly considered night bloomers. But when hybridized with *Zephyranthes,* they may open anytime between early morning and mid-day.

I learned that some hybrids produced maternal offspring no matter what kinds of pollens were applied to them, and I soon avoided them as seed parents. 'Apricot Queen' was a good case in point. I grew many seedling to maturity in less than a year only to find all were identical to the seed parent. It was not a total loss, as I found it could be propagated in quantities quickly if desired. In effect I had artificially produced potentially new "species".

I made many other interesting hybrids as well, such as combining the genes of *Z. pulchella* with the old classic hybrid "Ajax" *(candida x citrina)* and these were a tremendous improvement with their deeper richer yellow flowers. In one instance I got a flower nearly exactly like the *Z. pulchella* parent, save that it was pure white like its *candida* grandparent. I named this 'Wyndham Hayward' in honor of this late famed horticulturist. Indeed I was so glad to produce the many interesting colors that I named quite a few of them for horticultural friends. Some of these folks were flattered and a few were disappointed. Apparently they expected a super flower to bear their name rather than a small Rain Lily. What I was not always able to communicate was the fact that I was placing color as my main consideration. Size and form would have to be bred in at a future time. At this writing *I have no regrets about my priorities. Were I to repeat the experiment* again I would still place color as my first priority, followed by vigor, free flowering habits, hardiness, then form and size, in that order. While *Zephyranthes* flowers are individually very beautiful, their forte is that they can flower in large masses, and this is where they make their greatest impact in a garden. Thus if the color is good, they will add

to the landscape effect from a distance.

Eventually size and form came too, and when combined with clear strong colors, one could not wish for more beautiful garden effects. The largest flowers exceeded three inches in diameter, and a few were 4-5 inches across. 'Big Shot' was the champion with flowers often five inches across. 'Texas' had good four inch flowers and these were often on stems 16″ tall. 'Fire Ball' was tallest with flowers up to 18″ tall. It also holds my all-time record for number of flowers scapes produced from a single bulb in a single season . . . nine.

Ordinarily I would never try to ''clock'' the performance of one of my hybrids, but this 'Fire Ball' caught my eye when it produced a twin flowered scape for its first flower of the season. It had done this the year before as well so I decided to place a marker beside it in order to identify it from the other ''FIREBALLS'' in the planting. When it flowered again the second time, the scape was a normal single flowered one. The third scape was again twin flowered. This alternated the entire summer between a twin flowered scape and a single flowered scape . . . four each until on the ninth effort, the scape had three flowers! At this point it no longer resembled a *Zephyranthes* but looked like a miniature *Amaryllis* of some kind! The following year this same bulb reverted back to its normal pattern and produced only single flowered scapes. Never again has this hybrid, or any other for that matter, produced so much as a twin flowered scape.

A tendency toward doubling also occurred in some of the hybrids, and a few varieties, such as 'Twinkle', more frequently than not had an extra 2-4 petals which added to their charm. While I don't mind truly double flowers, I have always felt that a Rain Lily with 8-10 petals looks sort of absurd, but to my surprise I found that others don't share my feeling in this regard. Indeed I have been encouraged by very knowledgeable gardeners to strive for those with the extra petals as they insist that this increases their garden value. Though I don't agree I find it is an interesting point of view.

The most ''double'' rain lily I ever saw was in a field of *Z. smallii* var. minor in the outskirts of Brownsville. This specimen had twelve petals and truly looked like a small yellow Camellia. Another record holder in my experience was a single bulb of the species 53-1 (''Valles Yellow'') which at one time pushed up five separate scapes simultaneously. Its flowering appeared to be that of a clump, but it was only a single bulb. It was a sight not to be forgotten. Thus when these various species are incorporated into the hybrids, it is easy to see that many strange phenomena will occur from time to time as they come into flower.

Before abandoning the subject of color, it is well to mention progress in the red hybrid shades. This is still in its infancy but prospects for the near future are excellent. Aside from *Zephyranthes bifolia* and a few other notable Mexican species in the minority, there are few really good deep red flowered species that approach scarlet or crimson. Extreme forms of *Z. clintieae* and other allied Mexican complexes can

fall into the dark shades approaching carmine red, fueshia-rose, or rose red, all with purplish undertones, but very beautiful. But at Jacala, Hidalgo, Rain Lilies seem to have undergone an explosion in pigmentation. There we can find a complex of what may be only a single species in isolated and overlapping areas where can be found colors such as the basics . . . yellow, pink, and white. But it does not end there. There are also intermediate forms between these, and there are many shades of rose and red. The best red forms are a rich crimson, and these have been of some value in breeding. These have hybridized with the yellow forms to make up an interesting series of bicolors and "sunsets", as well as pastel blush-flesh pinks, etc. For convenience, I dubbed this group the "Jacala Rainbow" complex.

By using the Jacala crimson forms, I have truly exciting shades of hybrid reds, but all have so far been small flowered like the Jacala red parent. Thus in order to get new colors, we must sometimes retreat a step backward before we can move forward toward the ultimate in form and size. My best red-flowered forms in rich carmine red came unexpectedly through genes from the subgenus Cooperia. In about the third or fourth generation of breeding Cooperias with other *Zephyranthes*, sooner or later a red or near-red form is apt to suddenly appear. This was the case with 'Carmen Jones', my first really all-out good red. Its pollen was yellowish-white, showing its kinship to Cooperia, but the flower was of fairly good size and fairly nice form. The color was especially beautiful shortly after opening, before it began to fade. When it was crossed with other things, a veriety of hybrids, good and bad came forth. The genes are recessive and it takes a lot of breeding to bring out red flowered hybrids when outcrossed, but a few will appear. When selfed, seedlings of 'Carmen Jones' are nearly maternal. The finest step forward from 'Carmen Jones' was 'Red Witch', an ethereal beauty of rich carmine, but with a hazy picotee pattern of near white around the edges. The flower was fairly large as this color group goes, and was excitingly showy and beautiful. Unfortunately I somehow managed to lose it one winter and have since been plagued with pangs of guilt. What a pity. I also lost 'Steve Lowe', a fantastically gorgeous rose-red of medium large size, and perfection in form realized. The flower was at least as large as 'Ruth Page', but the color was richest rose red, with large, blunt, overlapping petals. One could not wish for a better *Zephyranthes* hybrid. But this too went the way of 'Red Witch'—in refining my best colors, I was losing vigor and hardiness.

In 1962 I added a new species from Mexico into my hybrid mix . . . 62-1 "Horsetail Falls", an early flowering large flowered pink from the Sierra Madre range just south of Monterrey, Nuevo Leon. This species is outstanding for several reasons: it is the earliest of all the Mexican species to flower in our area, flowering along with *Z. atamasco* here in March, April, and May, depending on the weather conditions. Because it is the nearest pink flowered species to our borders, it is

extremely hardy, and this is very important. The flowers are fairly large and of very good form with overlapping segments. Foliage is very broad and flat and it can perhaps make the largest bulbs in the *Zephyranthes* genus . . . nearly as large as baseballs when grown under optimum conditions. Though it rarely forms offsets, it will easily re-seed itself and thus is easily propagated. When crossed with hybrids such as 'Ruth Page', the seedlings in the first generation carry most of the characteristics of "Horsetail Falls" but they increase easily by offsets and flower over a much longer season. The form is essentially the same, but there is more variety in the many shades of pink and rose. These F-1 "Horsetail Falls" hybrids are fertile and the F-2 seedlings are similar but even more varied and interesting. I feel that an entire new strain of *Zephyranthes* can be had by breeding this species into existing hybrids. The foliage of these hybrids will be very wide and flat, and flowers will be rounder in shape and with segs very overlapping. Good hardiness and resistance to drought will be an extra benefit. In short, it can fill the same role as *Z. rosea* did, but flowers will start much earlier in the year, and hardiness will be much improved.

I once tried to make a series of crosses between 'Texas' and *Z. howardii* in order to obtain a new strain of super yellow flowered hybrids. Seedlings were very slow, but finally flowered in four years. They had most of the characters of *Z. howardii* in leaf and flower, but were not unusually large nor exceptional. 'Texas' had been used as the seed parent.

It will be noticed that *Z. grandiflora* was conspicuous by its absence in my breeding program. This was an arbitrary decision on my part. I had made up my mind from the start that I would not use either it or *Z. drummondii* (syn. *Cooperia pedunculata*) simply because it was much too obvious, natural, and unchallenging. I was trying to break new ground apart from the work of Mr. Lancaster and I planned to tough it out as long as I could. When I finally did cross *Z. grandiflora* with 'Texas' and 'Ruth Page', I was disappointed. Seedlings were varied but most unimpressive. I really had expected better.

Mixing the many genes in *Zephyranthes* results in the duplication and near duplication of unrelated existing species . A good case in point was 'Mockingbird', which mimiced *Z. grandiflora* in everything except the exact shade of rose-pink. The flower was the same size, same form, same foliage, etc., but there was not one drop of "blood" (genes) from *Z. grandiflora* in it. By intercrossing the hybrids enough, I was in effect coming up with a lot of artificial duplications of existing species without having to actually use them in breeding.

Our San Antonio climate is favorable for growing most *Zephyranthes* species outdoors and thus I never bothered much about hardiness as a factor to be considered in my initial attempts at breeding. I usually lost seedlings every winter, but considered those that lived as a survival of the fittest. This was unfortunate as I lost a lot of potentially beautiful things. The species of the West Indies are espe-

cially tender, and so are some of the Mexican species. Were I to begin a new breeding program I would make it a point to incorporate hardiness as a standard. There are plently of hardy species and the tender ones should be intercrossed with the hardy ones rather than intercrossed among themselves. A tender species like *Z. rosea* should never be crossed with another tender species or hybrid unless such hybrids are intended for greenhouse culture. 'Ruth Page' and its offspring were successful because *rosea* was bred with a much hardier species, *citrina*. *Zephyranthes* are found from hot dry sea-level prairies to alpine conditions where summers are cold and damp. Hybrids can conceivably be bred for almost any altitude. My own hybrids were bred for our San Antonio area, but had I lived in San Francisco or Denver I think I could have bred those alpines that like cooler summers similar to the Mexican plateau and highlands that would thrive outdoors where summer temperatures don't soar as high as they do in our area. Then there are the desert species that do very poorly here, such as *Z. longifolia* and a few other allies. These could certainly be bred for areas of West Texas, Southern New Mexico, Southern Arizona and Southern California. The possibilities are endless. I have grown a most varied sampling of Amaryllids and other bulbs since I became obsessed with botanical excursions in quest of new and rare species, and in hybridizing new and rare things, but I am firmly convinced that if I could restrict myself to only one group of bulbs, I would unhesitatingly choose the Rain Lilies. They are the *creme de la creme* of Amaryllids. The brightly colored miniatures that will work themselves into frenzied exhaustion during the warmer months of every year in order to flower in my garden. They are easily hybridized, and they grow quickly to maturity in 2-3 years (sometimes in but one year!), and then begin forming offsets to make a respectable clump. The color combinations and forms are without end, and nearly all please the senses. One need only obtain a half dozen or more species and hybrids to become "God" and create ones own floral critters. It is educationally fulfilling and a most rewarding experience. It has been gratifying to see my own Howard hybrids widely grown around the globe and complimenting the older Lancaster hybrids. Perhaps now is the time to wed the two strains in order to get those elusive super flowers with the perfect form, great size, and dazzling colors.

As for the future, I think there will always be room at the top for really outstanding clones worthy of bearing a clonal name. But most seedlings would be better utilized as color-strains . . . good yellows, good pinks, whites, reds, oranges, etc. There are many still elusive ideals that should be strived for. We need really great yellow flowered hybrids with BIG flowers of very good form. Existing yellow species are small flowered. 'Kitty Clint' is a larger-flowered yellow hybrid, but the color fades and the segments are rather narrow. All my orange flowered efforts have been very nice, but small flowered. The trick now is to work for the same colors in a larger flower. I purposely neglected breeding for white flowered hybrids and this was a mistake.

We can certainly use a few really outstanding white ones with all the other good qualities. The rose and pink shades are easily obtained and should be explored more fully. I purposely neglected them, but that means that others can work them for better size and form. The red ones are extremely exciting, but need a lot of work to bring them up to the level of the others. Tricolor and quadricolor combinations are exciting too. Unusual color patterns, like the picotee 'Grace Primo', which is essentially a light yellow flower with a rose-pink border, are very beautiful and unusual.

Cultural problems: One might conclude that *Zephyranthes* are the ideal garden flower, and in a way, they are. I could not imagine not having their lush warm colors splashing in profusion in my flower beds, but they have one major drawback that can't be overlooked. Their foliage is low, narrow and grass-like, which makes weeding difficult. Their foliage is attractive enough, but weeding must be frequently and painstakingly done by hand at regular intervals. *Zephyranthes,* being sun lovers are easily overgrown with all kinds of weed grasses, etc. and then they will sulk and flower poorly. I have found the best solution to the problem is to sterilize the beds in advance with a good soil fumigant. This tends to hold off the weeds for one growing season at least. After that, one must weed religiously, or remove all bulbs and refumigate on an annual basis.

Another problem is that many of the more robust growing species and hybrids tend—with the wink of an eye—to quickly spill over into places other than where they were originally intended. This can create lovely garden effects but can wreck havoc where named varieties are to be maintained separately. They can easily be grown in pots and will thrive easily if given a good soil and adequate moisture. I have found that they are very nice in flats, where quantities of them can be concentrated. I like using large styrofoam containers used for shipping tropical fish. This gives them all the room that they need and yet isolates them from one another and from the excessive weeds which will come along sooner or later. But they are at their best in the garden, in beds containing many clumps or colonies in all the various colors.

BREEDING BEHAVIOR OF DIPLOID AND POLYPLOID CRINUMS

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The genus *Crinum,* which contains some 150 or more species, is widely distributed throughout the tropical and subtropical world. Many species have a basic chromosome count of 2n=22, but there are triploids, tetraploids, hexaploids and other combinations on record. Several of the latter along with polyploid hybrids are in garden use. Recently it was found that both diploid and polyploid species as well as the hy-

brids produced a high incidence of parthenogenetic seeds. Other abnormalities such as andregenetic male seed have been noted. Since little is known concerning all of these complexities which crop up during plant breeding a brief summary of findings is presented.

In general no set rule can be given covering the normal crossings of diploid *Crinum* species. The crossing of widely unrelated species may suggest no particular problem whereas closely related species can fail. This is assuming proper temperatures and humidity existed at the time of pollination. If a fair supply of F-1 seed appears it may yield semifertile F-1 hybrids; if few seed, then one can anticipate sterile hybrids. Some plants like *C. pedunculatum* yield nearly complete or complete crops of maternal parthenogenetic seed. The above results depend upon the species, subspecies or even clones involved. The fertility of most F-1 hybrids is quite limited. Their pollens will often take on the parental species but selfing or outcrossing with other viable pollens often results in parthenogenetic seedlings resembling the maternal F-1 plant. Few F-2 seedling plants have much vigor. However, there are some exceptions.

Intraspecific crosses between *Crinum* subspecies often reveal many unexplained incompatabilities, particularly between the various forms of *C. moorei, C. bulbispermum* and *C. americanum.* Yet all of these species will outcross onto the others cited. In complete contrast the variants of *C. macowanii* will cross with great freedom and set generous quantities of vigorous seed. So we can conclude that most incompatabilities between species and subspecies are genetic in nature and that genetic isolation between subspecies in lieu of geographical isolation counts heavily in the evolution of newer *Crinum* types. As a consequence we find some difficulty in applying Jens Clausen's definition of a species and ecospecies to a number of these plants.

Triploid Crinums are sterile, we have the species *C. augustum* as a typical example with 2n=33. The same with triploid garden hybrids (allotriploids of the AAB composition) although we would expect some pollen fertility at times. The tetraploid forms of *C. moorei* and *C. bulbispermum* are large vigorous plants but difficult to outcross since they are prone to give only parthenogenetic seed, both diploid and tetraploid. The tetraploid *C. macowanii* behave likewise, but will set some hybrid seed with specific parents. Thus in breeding one does better by using the pollens from these plants. The "Orange River" red-flowered *C. bulbispermum* is a hexoploid according to Dr. Fernandes. It is prone to yield small triploid parthenogenetic seed of no garden value when diploid pollens are applied but responds readily to polyploid pollens. Most of the latter crosses are huge plants with massive bulbs, foliage and flowers. Many have viable pollen but only random plants set seed and at times this is parthenogenetic. Reverse crosses of tetraploid and hexaploid species on diploid species often yield triploids of the AAB composition, as cited, or AAAB tetraploids which have some viable pollen, but only set parthenogenetic seed which is difficult to germinate. The AAB and AAAB hybrids are largely dominated by

the polyploid parent and few are of garden significance.

Two hybrids, *C. 'Cecil Houdyshel'* and *C.* x *burbankii* were quite an enigma as breeders until it was realized that both plants were polyploids. Presumably there was a nonreduction of chromosomes when the crosses were made originally. Selfing of either usually gives considerable parthenogenetic diploid as well as tetraploid seed. In many instances these seed result in a pure line or near pure line throwbacks to the original parental species. The normal fertility of the pure line throwback seedlings makes segregation from the semi-pureline simple as the latter are usually seed sterile. True, some hybrid material supposedly of the AAAB and AABB composition appears at times and one or two of these clones set quite a little seed. From this breeding behavior we can conclude that the Houdyshel and Burbank *Crinum* hybrids are autotetraploids and not amphidiploids, that the gamets are autosyndetic in nature and operate as AA or BB and not as AB. Outcrossing with other polyploid pollens rather bear this out after one eliminates all of the parthenogenetic throwbacks which clutter up the breeding program.

Several supposedly pentaploid hybrids exist as the result of crossing the hexaploid Orange River Lily with other tetraploid species and hybrids. The writers 'Cape Dawn' is one example, a cross which has been duplicated many times. Most of these 'Cape Dawn' siblings are uniquely similar. A few color variants have appeared but less than 5%. More variability occurs in seed production but few second generation seedlings have ever flowered or been worth keeping. Back crosses of 'Cape Dawn' onto *C. bulbispermum album* often duplicates the results of pollinating *C. b. album* with the Orange River *C. bulbispermum*. In both instances we obtain intraspecific tetraploid hybrids presumably of the ARRR composition. These plants lack hybrid vigor and the foliage and blossoms are uniquely slender, differing materially from the two parents. The pollens from these seedlings appear sterile and to date only two seed have set for me on the plants. These undoubtedly are parthenogenetic. We can only conclude that genetic incompatabilities have developed between the Orange River hexaploid form and the Cape *alba* form of *C. bulbispermum*. It has been the writer's hope that potent intraspecific hybrid stock could be developed as has occurred in backcrossing and interbreeding *C.* x *burbankii* and *C. macowanii* variants.

Several of these problems were discussed with Dr. Edgar Anderson previous to his passing away. He was inclined to compare the genetic behavior of *Crinum* to *Narcisus* wherein the gamets comprising the various species retained their entities within the hybrids with little or no pairing and exchange of chromosomes. Thus without exchange the gamets from hybrids would reappear as pure-line or near such. Under these conditions his spindle theory of hybrid parts being intermediate between the P-1 and P-2 parents fails. Typical examples would be the hybrids of *C. americanum* with *C. moorei* or *C. bulbispermum* where the features of the latter plants largely predominate in diploid crosses and completely predominate when tetraploid *C. moorei* pollens

are employed. The bigeneric cross of *Crinodonna howardii* is another example. The *Crinum* parentage is greatly accentuated in the long tepaltubes and pedicels when tetraploid *Crinum* pollens like *C.* 'Cecil Houdyshel' are employed. But despite the blossoms becoming Crinum-like with the double dose of chromosomes the foliage remains identical to that of *Crinodonna howardii* including the bluntly rounded leaf tips.

Numerous other examples can be given concerning polyploidy and the problems experienced. Not all polyploid hybrids make good garden plants due to their immense size and large coarse blossoms. The same applies to polyploid species recovered from polyploid hybrids. In contrast, natural polyploid species are no larger than their equivalent diploid forms. The usual distinction is much deeper pigmentation in the blossoms and unexpected yields of small runt-like parthenogenetic seed of little value. Meanwhile the search goes on for hardy free-seedling species, compatable combinations and nonsterile hybrids. The following list includes the better known polyploid Crinum.

Table I. Known polyploid *Crinum* species and hybrids.

Crinum augustum Roxb. Sterile triploid. Habitat Seychelles.

C. moorei Hooker. Diploid and tetraploids. Hab. Natal. Source of tetraploid form unknown.

C. macowanii Baker emend Verdoorn. Diploids and tetraploids. Hab. Natal, Orange Free State, So. Rhodesia. Source of tetra. unknown.

C. bulbispermum (Bur.) Milne-Redhead. Hexaploid. Hab. Orange Free State.

C. yemense Deflers. Diploid and tetraploid. Hab. Yemen highlands.

C. x *burbankii (C. yemense* x *C. macowanii).* Tetraploid. L. Burbank hybrid.

C. 'Cecil Houdyshel'. (*C. bulbispermum* var. *album* x *C. moorei* var. *makoyanum*). Apparently a polyploid. C. Houdyshel hyb.

C. moorei x *C. macowanii.* Hyb. Unnamed polyploid by L. S. H.

C. 'Cape Dawn' (*C. bulbispermum* hexaploid x *C. macowanii* tetraploid hyb.) by L. S. H. Many siblings semifertile.

C. bulbispermum x *C. yemense.* Numerous unnamed diploid, triploids, 3:1 tetraploid and pentaploid crosses by L.S.H. & others.

C. macowanii var. *gouwsii* (Traub) Verdoorn *(C. gouwsii).* 2n=72. Transvaal.

PLANT LIFE LIBRARY—continued from page 26.

sources; a selection of perennials and their sources; and hardy ornamental grasses. The final section is concerned with planning and preparing the garden; choosing the site; sun and shade; soil and its modifications; plant division; tabular list of plants mentioned and an index to common plant names. The book is profusely illustrated, and is very highly recommended to all gardeners.

WILD PLANTS IN THE CITY, by Nancy M. Page and Richard E. Weaver, Jr. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York 10022. 1975. Pp. i-x + 117. Illus. An original paperback. $3.95.—The authors are known from their outstanding work at Harvard's Arnold Arboretum. After a general survey of the wild plants in the city, and directions for using the present handbook, particularly in identifying wild plants in the cities of the northeastern United States, the rest of the book deals with particular plant groups.—Description of herbaceous flower plants with other observations, and each species illustrated. The other groups, similarly treated, include, grasses and grass-like plants, trees and shrubs, and ferns. This profusely illustrated book is highly recommended to all nature lovers.

A GUIDE TO THE MEDICINAL PLANTS OF THE UNITED STATES, by Arnold & Connie Krochmal. Quadrangle-New York Times Book Co., 10 E. 53rd St., New York 10022. 1973. Pp. 259. Illus. First paperback edition 1975. $4.95.—The introduction deals very briefly with the folklore and science of medicinal plants; some historical background; hallucinogens; plant identification; drug plant sources; synthetic sources; growing drug plants and words of caution about self-medication; and a two-page bibliography. A lengthy guide to the plants, pages 22 through 240, takes up most of the space. Two hundred thirty medicinal plants are considered. For each the common names, plant description, habitat, what and when harvested; and uses are given together with illustrations. Appendices 1 and 2, and an index complete the volume. Very highly recommended to all interested in medicinal plants.

HERB IDENTIFIER & HANDBOOK, by Ingrid Gabriel. Sterling Publ. Co., 419 Park Av. So., New York 10016. 1975. Pp. 256. Illus. $6.95. The brief introduction is concerned with the medicinal uses and drying of herbs; the herbarium, and herb teas. Practically the entire text, pages 14 through 243, is devoted to the description of the herbs, each illustrated, some in color. For each herb the scientific name, popular name, family, range, description, elements contained, medicinal and culinary uses, are given. General, scientific name, popular name, and geographical **indices** complete the volume. Very highly recommended to all interested in herbs.

CREATE YOUR OWN NATURAL DYES, by Kathleen Schultz. Sterling Publ. Co., 419 Park Av. So., New York 10016. 1975. Pp. 96. Illus. $5.95.—In the introductory section, various topics are discussed—the equipment needed, terminology, water, dye sources, preparing dyestuff and dye liquor; basic dye recipes; preparing the yarn; the dye bath and dyeing the wool. The following sections are concerned with natural dyes; experiments with natural dyes; ancient dyes; guide to dye sources and mordants. A glossary, a roster of suppliers; a metric conversion table, and an index complete the volume. Highly recommended to all interested in natural dyes.

PLANTS FOR KIDS TO GROW INDOORS, by Adele Millard. Sterling Publ. Co., 419 Park Av. So., New York 10016. 1975. Pp. 124. Illus. $5.95. The author has laid out simple plant growing projects for children. For instance, with only the top parts of the carrot and beet, a sweet potato tuber, and an avocado seed, the child of very tender age may be initiated

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4. AMARYLLID CULTURE

[ECOLOGY, REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

POTTING MIXTURES FOR AMARYLLIDS: A SUMMARY

THOMAS W. WKITAKER, *2534 Ellentown Road, La Jolla, California 92037*

Mr. John Cage, in his informative article in Plant Life 31: 65-72, 1975, indicates there are many good potting mixtures for *Amaryllis*. Most of them consist of nearly identical ingredients, but usually in slightly different proportions. Mr. Cage recommends:

50% Mica Peat or Jiffy Mix
25% fine perlite, agricultural pumic or sand
25% leaf mold

Thalassa Cruso in a recent article about *Amaryllis* in Horticulture (Nov. 1975, pg. 34-37) suggests compost, or if this material is not available, a bag of peat moss, one of prepackaged soil, and one of perlite should be purchased along with a bottle of slow release fertilizer, preferably high in potassium. The precise proportions for the mixture were not given. She does state, however, the mixture should consist of compost, well peppered with perlite, or equal quantities of store-bought soil and peat-moss, well laced with perlite.

After much trial and error, that expert plantsman and amaryllid grower, J. L. Doran of Burbank, CA, recommends the following mixture recorded in his article in Plant Life 30: 97-103, 1974. Additionally, superphosphate and lime are added to this mixture in the amount of ½ teaspoon per 6″ pot.

2 parts organic (fiberous)
3 parts sponge-rok #3 (coarse)
2 parts fine sand
1 part charcoal #10 (10 mesh)
2 parts vermiculite #3

We have used the mixture cited below with good results for potting various amaryllids and lilies.

Washed Birdeye Gravel (coarse sand)	50%
Peat	25%
Perlite	25%

To these ingredients are added about 1 tablespoon of Osmocote per pot (8″). Osmocote is a slow release fertilizer, with nitrogen, phosphorous and potassium in the ratio of 11-14-14.

It is also important to treat periodically (perhaps 3-4 times per

year) with benlate or another systemic fungicide for the purpose of controlling pathogenic root fungi.

It is obvious from this summary, the prospective grower has a choice of several good mixtures for growing amaryllids. The success of any one mixture will depend upon the skill of the grower in adapting them to his needs. It is also evident that the last word about potting mixtures has not been said. There is much room for experimentation and improvement. I should add that the selection of a suitable potting mixture is only one step in a series of operations that are needed to produce thrifty *Amaryllis* plants. As Len Doran points out in the article cited above, good management of soil moisture, soil fertility, light relationships and bulb dormancy are equally critical.

HYBRID AMARYLLIS CULTURE MADE EASY

JOHN M. CAGE, *1041 Ruth Ave., Yuba City, California 95991*

Even the best of instructions one gets on growing and flowering commercial Amaryllis bulbs seem to contain pet ideas of advanced growers, ideas that are difficult for newer enthusiasts to put into practice. Where in the world can one buy thoroughly rotted manure with low salt content? To help my gardening friends, I have given them the instructions below. They seems to be reliable, and the ingredients recommended are available in almost any garden store.

Mature amaryllis bulbs will usually be received in the dormant stage, either rootless or with some live, fleshy roots. If a bulb has live roots, protect them carefully, for they are important in obtaining optimum bloom during the first season after replanting. Dormant bulbs may be stored in cool, dry vermiculite, sawdust, or peat moss for several weeks, or even several months in the refrigerator, but it is best to plant the bulbs soon after you receive them.

Best blooms can be grown in pots or other containers in a greenhouse, indoors in a sunny window, or on a protected porch or lanai. Use a pot about two or three inches larger in diameter than the bulb. Excellent drainage is essential. Bulbs can also be planted in light shade in the garden.

Soak dormant, leafless bulbs for an hour in a solution of Benomyl (Benlate), 1 rounded tsp. per gallon of warm water, before planting. *Wear rubber gloves.* Use same solution to water bulbs immediately after planting and once every 3 or 4 months while growing. Use same drench if you transplant growing bulbs.

Plant (in pots) in a good, sterile commercial mix. I endorse Super-Soil, Vitabark Potting Mix, or other light potting mix. Add about 25% clean sand if mix is not sandy or light and fibrous. *Do not add fertilizer.*

Spread any existing roots and poke some mix under the base of the bulb to avoid an air pocket, but do not pack hard. Leave about ½ of bulb above soil level and half inch space for watering. Keep soil *barely* moist and store at from 50 to 70 degrees F. until leaves start

to grow. Even if a flower bud emerges from the leafless bulb, just place pot in a well-lighted location and keep soil almost dry until leaves start. When leaves are growing, water fairly well, but let the soil get almost dry before watering again. Turn pot frequently to make the flower scape grow straight. *Start rootless* bulbs in warm place (up to 85°) until bud or leaves are several inches high.

In the winter, almost full sun at 70° is good until the first bloom opens; then more shade and a lower temperature will make the blossoms last longer. After the blossoms have withered, *keep the leaves growing in light shade until the following October or November.* In *late Fall,* stop watering and let bulb go dormant. If some leaves persist keep soil barely moist. Store cool and bring into growth gradually around Christmas time by placing in light and watering gently.

Fertilizer. Six weeks after planting, fertilize every two weeks during active growth with *soluble*, complete fertilizer (RapidGro) at 25% of strength stated on package. *Or* use 3 M Time-Release Tomato Fertilizer just once, scratched into soil surface. *Do not use solid fertilizer or manure.*

Pests. Use a rose dust or spray once a month, or more frequently if necessary, for mealybug, mites, or grasshoppers. Bait for snails and slugs.

Virus. Destroy any bulb with mottled leaves. At present this virus is incurable and contagious.

Outdoor Culture. Bulbs can be planted (with only the neck protruding) in well-drained soil outdoors in a sheltered location. Some varieties will do well. Full sun will burn the flowers. Transplant bulbs (October to December) to pots (as above) if desired for indoor bloom.

STORAGE OF **AMARYLLIS** SEEDS

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Purpose: To see if seed could be kept in variable room temperatures by reducing humidity. (Refrigerators loaded with seeds seems to cause objections by family members.)

Materials: Two batches of freshly harvested hybrid Amaryllis seed. Lot 1, from a home cross of a vigorous pencilled red dutch hybrid (Onderwater brand) X Ludwig's 'Marie Goretti'. These were harvested from large fast growing pods. Lot 2, fresh seed furnished by Dr. David Bell from a dutch-mead hybrid X *A. blossfeldiae* (both tetraploids). The seeds were enclosed in small manila paper envelopes.

Methods: An old fashioned chemistry laboratory dessicator, 8″ diameter, was on hand. This had a lower and an upper chamber, separated by a 1/4″ galvanized wire mesh. 1/2 cup of granular dessicant, Drierite (Anhydrous calcium sulphate, $CaSO_4$, W. H. Hammond Co. Xenia, Ohio), was placed in the bottom. While dry the color remains blue. When moisture capacity is reached, it signals by turning pink. The glass top was ground to make an airtight seal with the main part

of the dessicator. (An equivalent airtight receptacle could be made with a canning jar with rubber ring and screw top lid. In this instance, a layer of fluffed up cotton batting could be placed on top of the dessicant and seed envelopes on top of that.)

Many envelopes of seed were kept in this container, the top of which was removed only to put in or take out seeds.

The dessicator was kept in a kitchen closet located over a built-in oven. Temperatures (on spot checking) varied from 54° to 100° F. The closet doors were usually closed but no effort was made to insure continual darkness in the storage area.

Germination was checked by floating seeds in tap water in a lighted area.

TABLE 1. Amaryllis seed storage up to 16 months over anhydrous calcium sulphate, $CaSO_4$, in a dessicator.

Seed	Time of storage	Number of Seeds	Percentage Germination
Lot 1	0 (freshly harvested)	24	83
	9 months	20	80
	12 months	16	81
	16 months	10	80
	14 months	10	70
Lot 2	0	24	79

Conclusion: Preliminary data shows that successful low moisture storage of hybrid Amaryllis seeds can be accomplished at least up to 16 months with resultant germination of at least 70 percent. The experiment should be repeated with other crosses and longer periods of storage.

SUCCESSFUL **ALSTROEMERIA** CULTURE IN WASHINGTON

DONALD D. DUNCAN, *P. O. Box 238, Sumner, Washington, 98390*

For several years I have been growing Alstroemeria under less than ideal conditions with quite good results. Living in the Puyallup Valley south of Seattle, Washington, I have an excellent sandy loam soil but also an extremely high water table. In fact there are times during the winter when the Alstroemerias are covered with water for one or two days at a time. I must admit that this has caused the loss of some plants but what has surprised me most was that the majority of them have survived.

As a child, living in Newberg, Oregon, I had first seen *Alstroemeria aurantiaca* growing in my aunt's garden. Although it is often considered "common" its butter yellow flowers with maroon spots were exotic to the eyes of a young child. Years later I still feel that when grown well it is a wonderful addition to any garden. I later discovered the *Ligtu* hybrids with their glorious color range and grew these in Newberg also.

After college and a time in the Air Force, I settled on a small

farm near Sumner, Washington. I wanted to again try to grow those lovely flowers, this time with the idea of selling the cut blossoms to the florist trade. Seed was obtained from the old plants growing at my parents' home in Newberg, and were planted in $1\frac{1}{2}$ inch peat pots filled with a half sand, half peat moss mix.

I have found that *Ligtu* hybrid seed planted in this manner in spring and set outside in an open cold frame will start to germinate in six weeks. As soon as they are growing well, but before they break through the peat pots, they are planted out in the field. They are kept well watered and fertilized for the first summer to get as much growth as possible. A few of them will even bloom at that end of that first season.

The *A. aurantiaca* seeds are planted in the same manner but in the fall, and allowed to remain outside in an open cold frame through the winter. They will germinate in the spring and are then planted out and tended the same as the Ligtus.

In our climate, one of the most critical periods is the first winter. If it is a mild one there is no problem, but if the temperature dips to near zero as it does some years, the young plants must be mulched to prevent the frost from reaching them. I do this by applying a good layer of sawdust. The next spring the plants will grow up through the mulch and by the end of their second summer they have grown deep enough into the soil that they no longer require special protection.

The cut flowers have been well received by many florists, while others are reluctant to try something new. They would rather stay on the safe side with roses, carnations, chrysanthemums and gladiolus. What a pity! The *Ligtu* hybrids come in such beautiful colors, ranging from cream, beige, cantaloupe and orange through all shades of pinks from soft shell to deep watermelon. Both the aurantiacas and the Ligtus last exceptionally well as a cut flower.

As they become better known and as some of the newer hybrids from England and Holland are introduced into the florist trade, I am sure that they will be better accepted by both the florists and the general public.

1975 ZEPHYRANTHEAE REPORT

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I. THE NATURE OF RAIN LILIES

The genera *Zephyranthes* and *Habranthus* are very closely related, require the same general growing conditions and bloom according to their individual nature from early spring through fall. The flowers may be tiny (less than one inch across), medium or fairly large (three or four inches). Although deviations are known, the six petaled flowers are borne singly on petite scapes six to ten inches long or more robust

scapes of up to sixteen inches. Although *Habranthus* are usually soug for their larger bulbs and flowers, a wide range or sizes occurs in spec and hybrids of both genera. The blooms last for only a few days, b mature bulbs of many popular species and hybrids will average t to three scapes per season. Each bulb will not necessarily bloom the same time or with the same frequency. So, if groups of sever species and hybrids are grown, overlapping of bloom seasons and sp radic isolated bloom will give a long cycle of activity. Flower colo range from white, yellow and pink to deeper shades of gold, aprico orange red (rare), rose and red, with a predominance of various past shades in between ranges. Flower variegations are not as vivid as thos found in certain species and hybrid *Amaryllis*. There are many however, that display two or more hues and a more limited numbe that exhibit stripped or spotted effects.

Zephyranthes and *Habranthus* are often called Fairy Lilies, Zephy Lilies or Rain Lilies. These small amaryllids will bloom following thorough watering of garden or pots, but the most magnificent profusion of bloom occurs after a good rain shower during the blooming season. A bulb desparate to bloom might rarely do so on heavy humidity alone but buds normally appear from a few hours to a week following a shower. Perhaps you have noticed a similar phenomenon with other small amaryllids in the garden . A single clone of *Cyrtanthus sanguineus* is fondly called my "African Rain Lily." This naturalizes well in Galveston and is planted next to a rock in a garden border with bright filtered sun.

While *Zephyranthes* and *Habranthus* are native to the Americas exclusively, one can imagine the great diversity in climate, altitude and geological soil structure found in this large area. I'm sure that more than one collector of amaryllids has seen bulbs blooming in standing water, in almost pure sand and gravel or between cracks in boulders high on a hillside and has been prompted to note: "What in the world are you doing here!" Fortunately for us, most Rain Lilies are easily adaptable to home growing conditions and newly introduced species and hybrids are eagerly sought for trial.

II. CULTURE OF RAIN LILIES

Here are the basic rules for growing *Zephyranthes* and *Habranthus:* Choose a sunny spot with loose, friable soil (sandy loam is best) that drains well following heavy rainfall. Rain Lilies are most effectively used as a border for the garden or alone in narrow beds and other confined places. They particularly enjoy growing near rocks, bricks or even cement paving. A soil pH from neutral to alkaline is generally best for most species and any good feeding program formulated for your area may be used. Actually, good drainage and light are probably more critical factors than soil or water pH for many Rain Lilies, providing the pH is close to neutral. Those of you who read Dr. Walter Flory's very popular article, *Rain-Lilies*, in the March 1975 issue of HORTI-

CULTURE may have noted the recommended general use of "somewhat acid loamy soils", with certain species requiring calcareous soils excepted. This apparent disagreement reflects local growing experiences and demonstrates the adaptability of many of these small bulbs. *Z. atamasco* needs a little richer, more acid soil. At the other extreme *H. concolor, Z. longifolia* and a few other species from rocky desert areas are very difficult to bloom without a very high pH adjustment (and possibly some other conditions too). Species from the West Indies and certain coastal areas also prefer an alkaline environment in order to perform best. Both Drs. Traub and Flory have written that *Z. albiella* prefers an acid soil. This must be a very tolerant species, for it receives copius amounts of hard Galveston water during extreme dry spells and blooms abundantly in the spring and early summer. *Zephyranthes* and *Habranthus* bulbs should be planted about two inches apart in the ground with the top of the neck where new leaves emerge at soil level or just slightly above. Protect from freezing temperatures. Many species of these genera are hardier than most people realize, particularly if the bulbs are mature and healthy. A winter mulch is sufficient for most all areas in the south. With prolonged ground freezing temperatures, dig and store like other tender bulbs or transfer to containers which may be protected.

For containers, use your ingenuity or stick to the standard four to eight inch clay or plastic pots. Simple planters may be constructed of redwood or cedar fencing material. The small pots are useful for a single medium to small bulb or several tiny ones. The larger *Habranthus* and *Zephyranthes* with long bulb necks will require pots with greater depth. A six inch pot will usually handle a full seed capsule for germination. To a standard potting soil mix, add an additional one fourth to one third portion of grit mixture. The best is a combination of perlite and something calcareous like crushed shells or limestone pebbles. Use mixed sizes for larger containers, if possible. Activated charcoal is great and don't forget the bonemeal. Believe it or not, crushed oyster shell is not available in Galveston nurseries. I have to gather my own small shells to add with chert pebbles. Bulbs may be planted as close as an inch apart, if necessary, and the top of the neck should be more or less at soil level. Allow plenty of room at the top for thorough watering when needed and give the pots at least one-half day's sun. If filtered sun is desired in a very hot climate, the use of deciduous trees for cover is ideal because it allows almost full winter sun. Follow a routine feeding schedule and water the pots thoroughly only when dry. You will probably find that much less frequent watering will be required during the colder months. Even evergreen bulbs should be kept on the dry side. If you suspect that hard water impurities have built up during long summer drought periods, flush the pots with four or more repeated waterings and follow with regular feeding. An occasional frost or light freeze should not damage bulbs or foliage in pots. Prolonged exposure to temperatures below 35° F. or predicted temperatures below

32° F. should probably be avoided. Weather is sometimes more severe than predicted and pots are more exposed to cold.

Zephyranthes and *Habranthus* are not prone to disease. For example, they will easily pass by visual inspection of Department of Agriculture officials if the bulbs are carefully washed and trimmed. Each one of you could probably write an essay on your most troublesome chewing or trampling pest. Spring is the worst time for bud damage by snails, slugs or worms. Fortunately the foliage will recover quickly, but who wants to wait perhaps another year to see a new variety bloom. Plan a vigilance long before buds are due and by all means use sight, hands and bait—there is certainly no single solution. Snails and certain worms feed at night and moisture activates snails and slugs. If hiding insects such as mealy bugs and bulb mites are a problem, plan a followup treatment with a systemic or contact pesticide or a combination of the two. A single treatment may not be enough, particularly close to a dormant cycle or slowing down of growth activity.

Rain Lily seeds are easy to germinate if they are mature and reasonably fresh. For best results, plant seeds from one to six weeks from harvest date. They are produced in several shapes and sizes, but most are fairly flat. Certain species such as *Z. candida, Z. rosea* and *Z albiella* have just a few seeds and these are quite plump and almost round when harvested. Your favorite easy method for seed germination should be satisfactory. Seeds may be started indoors during cold weather or outside in semishade during the hot season. If a plastic cover is not used, try anchoring a piece of absorbent kitchen paper towel with toothpicks. Seeds will stay in place when watered and leaves will come through the paper. First transfer if desired, may be made as soon as a small bulblet has formed (tallest leaf will be three or so inches high). When seed flats or pots cannot be elevated, toothpicks will also discourage frogs from resting among seedlings (at least this has worked so far). My seed raising experience is far from vast, but the only real difficulty I have encountered with Zephyranthea was with a group of seeds collected by several expeditions in the Andes. For the most part, these were rare *Rhodophiala* species and not a single one survived my methods and climate. Few *Zephyranthes* and *Habranthus* are this tricky.

If you happen to have a nice hybrid Rain Lily that sets seeds, don't hesitate to increase your stock in this manner. Chances that the seedlings will be maternal are great and poor ones, if any, may be discarded. Actually, seed selection is highly satisfactory with these genera and may be used to improve vigor in both species and hybrids. In nature there is renewal by seeds and offsetting. While this does not mean that a favorite clone will automatically go into a decline with age, you may find it happening to a few or you may possess a single bulb that does not perform as expected. (This is assuming that satisfactory care is provided and adaptability has been proven.) In 1970 we collected some *Zephyranthes* growing in very rocky limestone hills about 88

miles from San Luis Potosi on Highway 86 toward Valles, Mexico. My mother kept six bulbs to grow in Brownsville and hers never bloomed. Out of my pot of a dozen bulbs, two bloomed the following year and have continued to bloom each July. The flowers have nice *Z. macrosiphon* type form and are a pretty cool pink with a white center. Some time ago I should have raised some seedlings and discarded the other ten bulbs.

If you have tried Rain Lilies for a season or so and they are not performing as you would expect, review the basic rules and survey your growing area. Perhaps conditions have changed since the bulbs were planted. This was demonstrated recently by a knowledgeable and well known grower of tropical plants. Both Day Lilies and Rain Lilies were not flourishing at a relatively new homesite. Two trouble spots were found: Trees and shrubbery had grown more rapidly than expected, giving too much shade, and the special mixture used for top soil was probably too rich in organic matter. J. L. Doran's *Amaryllis Growing* (PLANT LIFE 30:97-103, 1974) contains many excellent basic points which may be applied to anything grown in a container. Because my gardening is on a small scale, I purchase a brand of potting soil that is consistent at a discount store and mix additional grit with it. Look for one that contains ground bark as organic matter in place of peat. Devise means of freshening the soil each year, but don't hesitate to repot occasionally. Some species in the wild grow in outlandish places and are forced to store nutrients during a rainy season. However, as Doran points out, a pot is a different environment entirely and cannot be compared to any natural habitat. Although little is known about specific requirements, don't forget trace elements in a feeding program, even in the garden. Many bulbs in the ground should not be disturbed; however, others might benefit by having their area reworked every few years. To avoid possible bulb damage, keep weeds out regularly. Bulbs may be disturbed any time during the growing season. Late summer or early fall is ideal in my climate. A final word: Rain Lilies will tolerate much neglect, many bedfellows and short periods of many extreme conditions . . . but they will not stand constant moisture, particularly combined with too much shade or cold.

III. RECOMMENDED RAIN LILIES

Recommending a list of dependable *Zephyranthes* and *Habranthus* species and hybrids could become a study in depth for various growing areas. However, the species most commonly grown are tolerant of varying conditions, are probably pretty hardy and are usually the most available commercially:

Z. X *ajax*—This is a very old hybrid combination of *Z. candida* and *Z. citrina* and is often listed among species *Zephyranthes.* The flowers may vary a little in size, form and color intensity, but all are excellent garden bulbs for bloom during the summer and fall months. Some back crosses with both species are superior and some clones in

this group may be fertile.

Z. candida (subgenus *Argyropsis* Herb. ex. Ravenna)—This white species, said to have been introduced in 1515 from Argentina, blooms abundantly in late summer and fall and offsets rapidly. It is an "escape" plant in certain areas and thus is mentioned in H. W. Rickett's WILD FLOWERS OF THE UNITED STATES, VOL. III TEXAS and C. A. Brown's WILDFLOWERS OF LOUISIANA AND ADJOINING STATES and perhaps others. *Z. candida* is among the hardiest of these genera.

Fig. 23. **Habranthus brachyandrus** from Paraguay growing in a corner of a Florida garden. Note the profuse flowering from a single clump. Photo by Mrs. Gertrude Jeffrey.

Z. citrina—This is the most satisfactory and popular of the yellow species and comes from the West Indies. It blooms in late summer and fall, sets seed abundantly and has been extremely valuable in hybridizing.

Z. drummondii D. Don (syn. *Cooperia pedunculata* Herb.)—This is a very robust white species from limestone hills in Texas and adjoining areas of New Mexico and northern Mexico. It adapts well and has been useful in various scientific studies and in hybridizing. Several of the Percy-Lancaster hybrids are sometimes still available and may be listed as "*X Cooperanthes*" (*Z. X lancasteri* Traub and X *Sydneya* Traub). A discussion of these and other hybrids may be found in the 1959 issue of HERBERTIA (Traub, Hamilton P. Hybrids in the Tribe Zephyrantheae. HERBERTIA 15:37-41 1959).

Z. grandiflora—The bright and large rose pink flowers appear in

summer to fall on the species and it is reported to be from Guatemala as well as parts of Mexico. Most forms are self sterile, but it offsets gradually to form large clumps. It is an "escape" plant in Galveston and other places and so widely popular that it is rumored to have been successfully grown in Alaska (with some winter protection no doubt!). Sometimes listed as *Z. carinata* Herb., this lovely flower has been somewhat mimicked through hybridization of other *Zephyranthes* by Dr. T. M. Howard. It was interesting to note in Dr. Flory's article, *Rain-Lilies* (see earlier reference), that regular flowers of *Z. grandiflora* have 48 chromosomes, while forms with semi-double flowers or aberrant blooms have an odd number of chromosomes. Apparently the tendency toward aberrant blooms in other species and hybrids of these species is not necessarily a permanent feature and therefore may not be indicated in the chromosome count.

Z. rosea—This is another extremely popular Rain Lily from the West Indies. It was also collected by J. L. Doran in Panama. The plant is fairly small in all proportions and the bright rose flowers with white centers usually appear during the summer months. Very few small seeds are produced, but it offsets easily and makes a fine subject for pots. It blooms particularly abundantly in gardens of southern Florida and is noted for occasional blooms with extra petals. It is very valuable in hybridizing. Dr. T. M. Howard's *Z.* X *ruthiae (Z. rosea* X *Z. citrina)* has produced the Award of Merit clone 'Ruth Page' and the late Alex Korsakoff's 'Ellen Korsakoff'. Dr. Howard used 'Ruth Page' as a seed parent to obtain many other fine hybrid *Zephyranthes* of good size, form and unusual color range. With pollen from a variety of species and hybrids, he also introduced qualities such as adaptability, hardiness and quantity of bloom.

Z. smallii (subgenus *Cooperia* Traub)—This dependable yellow flowered species comes from a very limited area around Brownsville, Texas and will probably become extinct in the wild. Two flower sizes are known and if the form on some is not perfect, abundance of bloom more than compensates. Multiple scapes are often produced and some clones may have flowers with extra petals periodically. Season is summer to fall, it offsets gradually and is very fertile.

H. brachyandrus (Fig. 23)—You can't overlook this South American species in the garden. Flowers are large, trumpet shaped and vividly colored orchid pink with a flower base of dark but bright burgundy. While seed setting is unpredictable in some areas, the bulbs offset to a fault. If this hampers the summer blooming of mature bulbs, provide better drainage. Certain clones of *brachyandrus* show the greatest tendency among Rain Lilies toward odd flowers. This species suffered damage during the 1962 heavy freeze in Brownsville, although it passed through the same freeze in Houston unharmed.

H. robustus—Great for mass planting, this large and lovely species also comes from South America. A mixture of *brachyandrus, robustus* and their hybrid, *H.* X *floryi* can be very effective in the garden. Flowers appear in the summer and are usually three toned—lime or darker

green at the base, whitish center, then pink. They are, however, variable in size and intensity of color. This plant thrives on neglect and reproduces rapidly by offsets and seeds. With mass planting, twin flowers and some doubling may be found.

H. tubispathus (L.Herit.) Traub Synonyms are *H. andersonii* (Herb.), *H. texanus* and it is sometimes listed as Texas Copper Lily. This small yellow *Habranthus* is from Texas and South America. Flowers may be flushed with reddish brown, or have a few darker striations in the center. A yellow type from South America, possibly more robust than the Texas one, is sometimes called *cupreus*. *H.* [illegible] Traub was new in cultivation a few years ago and now is quite popular, being particularly adaptable in California. [illegible] Mueller ('Rosemary') Traub is still quite rare.

The following is a supplemental list of *Zephyranthes* and *Habranthus* which should be more widely grown whenever seeds or bulbs are available:

Z. abiella—"Little whitey", as it was named by Dr. Traub (PLANT LIFE 6: 31-53, Fig. 6. 1950) is a charming free blooming *Zephyranthes* from northern parts of South America and perhaps Central America. With small bulbs, dainty flowers and shiny foliage, it is best appreciated in a pot. It sets very few small round seeds, but offsets freely. Bloom season is spring to early summer, but it is likely to flower in late winter if the pot is allowed several months' dormant period before being placed under indoor plant lights and given water. A pink *Zephyranthes* resembling *albiella* was collected by the late Prof. Ira F. Nelson in Panama. This is thought to be a possible natural hybrid (with *Z. rosea?*) and blooms during the summer. The late Alex Korsakoff used *Z. albiella* in hybridizing and it should be tried more frequently. OK folks, how about a yellow *albiella* type, or another X. *Sydneya?*

Z. atamasco—This large white flowered species is native to our southeastern states from Mississippi to parts of Florida. It flourishes in a little richer, more acid soil and therefore is not as popular in areas with different soil conditions. Pot culture or special treatment is recommended as being worth the effort. The flowers, though variable, are large and well formed. Buds may be a bright rose in cool weather. It blooms in the spring, sometimes quite early, and spreads by offsets and seeds. The cool temperatures that extend the lasting quality of the flowers may also inhibit seed setting in some areas. A hybrid between *Z. atamasco* and a pink Mexican *Zephyranthes (Z X flaggi)* is more adaptable than the maternal parent and Korsakoff's registered hybrid X 'Nicetria' *(Z. X flaggi* and *Z. grandiflora)* is quite lovely. *Z simpsonii* and *Z treatiae* have been named from restricted parts of the above general native area and these are perhaps a little more difficult to adapt. My own experience, however, is based on growing a single bulb of each.

Z. flavissima (subgenus *Argyropsis*) Ravenna (PLANT LIFE 25: 154, 1969 and PLANT LIFE 27: 67-68, 1971)—This yellow-flowered species is recommended with the hope that more plant material will

become available from South America for trial. For sometime I have grown single clones of unidentified yellow species from Santa Catarina, Brazil and Entre Rios, Argentina. Since *flavissima* is known from these areas and my flowers fit within the description, their identity is fairly certain. Bulbs of my two are easy to maintain, but July flowering can be notional. The deep yellow flowers are quite lovely, fairly open with evenly arranged petals. Here, it has been completely sterile, but the tiny bulbs will offset.

Z. herbertiana Dietrick (Subgenus *Cooperia* Traub)—Some synonyms for this fragrant little weed are *C. drummondii* Herb. and *Z. brazosensis* Traub. It is native to several of our states and further south and the small white flowers usually appear from mid-summer to fall. The ordinary variety is not a showy garden subject and it spreads rapidly by offsets and seeds; however, some special large flowered forms are sometimes available. From its natural range, this species is one of the hardiest and toughest of the two Rain Lily genera. Another white *Cooperia, Z. traubii,* is native to a short portion of the Texas Gulf coast. Its flowers are lovely, but it is difficult to bloom away from southern coastal areas.

Z. insularum—Similar in growth habit to *Z. rosea*, this small white flowering native of the West Indies is an "escape" plant from cultivation in some Mexican coastal areas, southern Florida and perhaps some other tropical places. While bloom is not quite so luxuriant elsewhere, the bulbs are easy to grow and multiply in a pot. Their flower petals are arranged in a different manner and the species is not as tender as perhaps their size, delicacy and habitat might indicate. A clump grown in the ground in Houston, Texas survived the deep freeze of 1962. A somewhat similar but more robust white species with fine flower form is *Z. puertoricensis.* This also grows and multiplies easily in a pot, but is more tricky in bloom performance. *Z. puertoricensis* was sent to Dr. Traub for identification in 1949 (PLANT LIFE 7: 37-38, Fig. 4a. 1951) by Dr. Harold F. Winters while he was assigned to Mayaquez, Puerto Rico. Dr. Winters is currently Research Horticulturist, Germplasm Resources Laboratory of the Agricultural Research Service in Beltsville, Maryland and is one of the many members of The American Plant Life Society who has submitted plant material for the study and enjoyment of all. For over one hundred and fifty years, this taxon had been erroneously labeled *Z. tubispatha* in commerce (Flory, W. S. The Chromosomes of *Zephyranthe: Insularum, Z. Puertoricensis* and *Z. Nervosa,* HERBERTIA 15: 55-63, 1959.)

Z. pulchella—This bright yellow species is native to areas around Corpus Christi and Brownsville, Texas. They often seek low dry places that flood for a short time following heavy rainfall; however, they are not difficult to adapt to regular garden conditions. It blooms in late summer to fall and very closely resembles *Z. citrina*, including the ability to set a large number of seeds. Of the forms I have grown, the leaves of *pulchella* are more slender than *citrina,* the stigma is tiny for the genus and the flowers are perhaps a bit more open and refined (on the second

day). Two other yellow-flowered *Zephyranthes* grow in special areas near Corpus Christi and these have been named *Z. refugiensis* and *Z. jonesii* (subgenus *Cooperia* Traub). These two species present no special difficulties in culture and make fine additions to a collection of rare bulbs.

H. cardenasiana—Similar in size and growth habit to *H. brachyandrus* and *robustus*, the flowers are white with a pink flush and appear in the spring and early summer. It comes from Bolivia and a clue to it identity is the deeply cleft and slender three-part stigma. Under cultivation here, it sets seeds poorly and the blooms rarely last over a day. On the plus side, the bulbs are easy to grow and flower and it may be brought into bloom indoors in late winter.

H. martinezii—This new *Habranthus* was used in hybridizing by the late Alex Korsakoff as both seed parent *(H. martinezii* x *H. robustus)* and pollen parent (*Z. albiella* x *H. martinezii* = X *Sydneya* 'Teddy Buhler'). It was introduced to cultivation by Dr. Carlos Gomez Ruppel, Argentina, (Paul H. Williams, Jr., PLANT LIFE 25: 36-37, 1969) and named and described by Pierfelice Ravenna (PLANT LIFE 28: 121-123, Fig. 29a, 1972). The bulbs adapt well to ground or pot culture and increase mainly by offsets. The flowers have nice *Habranthus* form, are intermediate in size between *H. tubispathus* and *H. robustus* and are off-white in color. Base of the flower is reddish brown and green, with upper striations of pale muddy grey or pinkish grey. The bulbs bloom from spring to early summer, although late winter bloom may be achieved indoors at times following a period of dormancy.

Much has been discovered and written about the Zephyrantheae of the Americas; yet, there is much more to be learned. In Mexico particularly, ingrading among species is a problem for taxonomists. While most gardeners would prefer to have a proper name for his favorite plant, characteristics such as adaptability, flower production and beauty are really more important. A brief review of the *Zephyranthes* and *Habranthus* of Mexico will be attempted in a future report. In the meantime, don't hesitate to try anything listed only by a plant collection number, nickname or locality. Chances are high that these have withstood from ten to more than twenty years of cultivation in the United States and elsewhere.

IV. SOURCES OF RAIN LILIES

There are no commercial sources for a full list of *Zephyranthes* and *Habranthus*. Perhaps demand will improve the situation, but this will take time. Members of APLS interested in small bulbs can help by sharing and exchanging seeds by mail and through local clubs. Please remember the courtesy of a stamped self addressed envelope when requesting information from any member or officer of APLS. This may also help speed a reply.

CLIVIA CULTURE—1976 Report

RANDELL K. BENNETT, *3820 Newhaven Road, Pasadena, California 91107*

In the few years I have been growing members of the Amaryllidaceae there is one important thing I have discovered; commercial planting mixes are generally not suited to the optimum growth of plants of this family. Perhaps others have had success with a particular mix but I have not. It took me quite a while to decide to experiment with my own mixes and therefore I am still in the experimental stage but the results look fruitful at this point.

In this article I would like to describe my experiences with the genus *Clivia.* I consider this genus the finest of the family, no offense intended to those who have preferences for other genera. Species of this genus have beautiful dark green foliage, spectacular clusters of orange or yellow flowers, and fruit which lasts on the plant for as long as a year, gradually changing color from green to red. Besides the physical attributes. *Clivia* species are of relatively easy culture as long as a few rules are followed. Because of their natural preference for deep shade conditions they are also adapted to home or porch growing.

While Clivias seem foolproof at first glance there are some rules to be followed in their culture. They should not be planted in a loose airy soil. The thick, finger-like roots need a more substantial mix. Although they thrive for a while, they may suddenly go into a decline. This is what happened to a specimen I had of *Clivia miniata* var. *flava.* Clivias tend to give ample warning when something is culturally wrong. Under pot culture they may begin to send up narrower foliage. The plants will also begin to lean over indicating that something is wrong with the root system. At this point it is suggested that the plant be repotted in a heavier mix.

It is often thought that Clivias resist being repotted frequently since they are known to flower better when rootbound. However, I have found that they are one of the most tolerant plants with reference to transplanting and if something is suspected as being wrong there should be no hesitation in unearthing the plant to check for root rot or any other problem. In the case of my *Clivia miniata* var. *flava* most of the root system had rotted away, causing the plant to tip in its pot. This plant is now growing in a mix of one part redwood compost, two parts garden soil (decomposed granite in our area), and a few pinches of bonemeal and insecticide/fungicide. I am still waiting for the results of this mix but it does look promising. One advantage of growing *Clivia* is that there is no bulb to rot away and thus leaving you with nothing. The roots may rot away under adverse conditions but I have never seen the entire basal plate disintegrate. Therefore new roots simply emerge from the plate.

Two other symptoms of improper culture have also been observed.

I believe that excess application of nitrogen fertilizer may result in abnormally long, thin, weak leaves. Also, strangely undulated leaves have emerged at times. This could be due to a variety of reasons.

Among the species I am currently growing are *Clivia caulescens*, *C. miniata*, *C. miniata* var. *flava*, *C. nobilis*, and an unidentified species which will be described more fully at the end of this article.

Clivias thrive outdoors in the open ground in this area. All they require is rich soil, shade, and ample moisture. Even if these requirements are not met they will still endure. In poor soil the roots remain close to the surface in search of nutrients and moisture. On the hottest days direct sunlight will burn the foliage but new leaves quickly appear.

Other than root rot the biggest enemy to Clivias has to be the mealybug. This pest finds a perfect environment deep within the leaf axils where it is moist and dark. Mealybugs feed on the new emerging growth, causing stunted leaves and eventually halting growth. I have never lost a plant to mealybug, even after they have gone undetected for a long time. However, this pest can turn a beautiful thriving specimen into a brown and white mess. Frequent rinsing of the foliage is very beneficial along with applications of insecticide when the mealybugs first appear. If they are seen on only a few plants, alcohol will do the trick. In any case, when the pests are eliminated the plants quick return to normal.

A few words about my unidentified *Clivia* species will end this brief discussion of the genus. I obtained this plant a few years ago from the now closed Oakhurst Gardens. At that time the plant was believed to be around ten years old. Some other specimens should be in circulation somewhere. There are no offsets yet. The plant is dwarf in habit, being only one foot high. It is thought that it will eventually be a little taller but not much. The dwarf habit is easily maintained if the plant is not pampered, but pampering does not result in much increase in size. At present my specimen has eight leaves with another emerging. The foliage is arranged in two ranks. Under certain light exposures these ranks will form in a single plane. When this happens the entire plant will appear to be about one inch wide when viewed from the side. The leaves are around one inch wide throughout their entire length and are rounded at the tip. The longest is about 35 cm. The outstanding quality of the dark green leaves is their stiffness. The effect is that of a narrow-leafed *Haemanthus albiflos.* The plant has not bloomed yet, and is not known to have ever bloomed. Growth is quite slow but significant change can be observed in a year. If it ever does bloom photos will be submitted. Culture is like other species. Meanwhile, I will continue to experiment with cultural techniques for Clivias and other genera.

Plants wanted by Randell K. Bennett, 3820 Newhaven Rd., Pasadena, Calif. 91107.—I am turning to the American Plant Life Society in an attempt to locate some plants that have been hard to find in the

trade. If anyone is growing any of the following I would be appreciative in knowing:

Eurycles sylvestris (E. amboinensis)
Eurycles cunninghamii
Hymenocallis macrostephana
Hymenocallis littoralis var *varigata*
Clivia gardenii
Cyrtanthus purpureus forma *albus* (Vallota)
Eucharis—all species except *E. grandiflora*
Tacca—all species

P.S. I have a dwarf, unidentified species of *Clivia* which I would sure like to have identified. It has dark stiff leaves all under 12" in length. They are rounded at the tip, less than one inch in width and of the stiffness of *Haemanthus albiflos*. The plant is at least ten years old and was purchased several years ago from Oakhurst Gardens in Arcadia. Alice Gans did not know its true identity.

1974 and 1975 DAYLILY REPORTS

W. QUINN BUCK, *Chairman, Daylily Committee, 26 East Camino Real, Arcadia, Calif. 91006*

1974 REPORT

In reflecting on the 1974 season, which was full of our usual pleasure in seeing new varieties and new seedlings, it is easy to become nostalgic and go back to the 1930's when Dr. A. B. Stout's important introductions of species and hybrids from the New York Botanical Garden were the major influence and the biggest step forward in daylily breeding. Mrs. Elizabeth Nesmith in Massachusetts and Mrs. Bright Taylor in Florida were subsequently major contributors in daylily breeding, along with Dr. Hamilton P. Traub, Wyndham Hayward, and Ralph W. Wheeler in Florida.

Orville W. Fay and Miss Edna Spalding come to mind as important influences, and then such figures as Bro. Charles Reckamp, Elmer Claar, David Hall, Hubert Fischer, Stanley E. Saxton are remembered. In the South the work of Frank Childs, W. B. MacMillan, Wm. Munson, Jr., Dr. John Lambert, Mrs. W. T. Hardy, and Robert Baker Wynne can be recalled as most outstanding.

The age of the tetraploid daylilies began in the late 1940's with the Schreiner, Buck, and Traub induced clones. The next step forward was the landmark Fay-Griesbach work about a decade later, followed quickly by such important polyploidizers and breeders of tetraploid daylilies as Dr. Virginia L. Peck, Wm. Munson, Jr., James E. Marsh, Steve Moldovan, Bro. Charles Reckamp, Nate Rudolph, Dr. Currier McEwen, Frederick M. Benzinger, Clarence Blocher, and Stanley E. Saxton.

One wonders why more introductions were never made of the Traub tetraploid seedlings grown at his first La Jolla garden. Many fine appearing seedlings presumably were not appraised as worthy of in-

troduction, but one wonders if they were completely lost and never used for breeding. Marvelous reds, pinks, lavenders, besides the more usual yellows, creams, and oranges, come to mind.

The progress in the tetraploids is quite amazing when we consider the material from which they are derived. The Marsh lavenders and purples, the Peck reds, roses, and pinks, the Reckamp melons, the Fay reds, wine, pinks, and miniatures, the Blocher reds, pinks, lavenders, and purples, the Munson strongly reblooming evergreen clones and marvelous eyed varieties, and the extraordinary Marsh lavenders and purples, already give up much to enjoy and look forward to.

Judging from very excellent slides ,the 1974 season saw Dr. Peck flowering superb reds, roses, pinks, purples, and lavenders. Dr. Traub bloomed a fantastically large melon which he has named, 'Melon Supreme' (Traub). Jim Marsh named two additional super lavenders. George Lenington selected some outstanding new clones for future release, and he used treated forms of 'White Formal' and 'So Lovely' for his breeding work. Bill Munson named a number of marvelous eyed varieties derived from his 'Bishop's Crest'.

In the Buck garden highlights of the blooming season would include 'Dancing Shiva' (Moldovan), a round medium sized flower of a lovely smooth pink; this one must be watched to see if it has better spike and plant qualities on an established clump. 'Mary Moldovan' (Moldovan) was again pre-eminent among the melons grown, being approached only by 'Parian China' (Reckamp) and 'Ivory Marble' (Munson). 'Silent Spring' (Munson) rebloomed well and so became one of the outstanding melons.

Among the whites bloomed the treated 'Robert Way Schlumpf' (MacMillan), the treated 'White Wings' (MacMillan), and treated 'White Frost' (Gore) were outstanding. The new diploid 'Serene Madonna' (Childs) was extremely white and very smooth in texture on a first-year plant; it must be polyploidized for use in breeding.

'Cherry Cheeks', 'Jock Randall', 'Cherry Chin' (Peck); 'Domani', 'Queen's Grace', 'Secret Garden' (Munson); and 'Chicago Silky' (Marsh) were again most outstanding among pinks and roses. 'Wine Bold' (Peck) was the clearest, most sunfast of this color. 'Douglas Dale', 'Jolly Pinder', 'Lusty Lealand' (Peck); 'Johnny Ward' (Fay), and the treated 'Shining Plumage' (Hall) were outstanding reds for quality or performance. 'Capt. Reid' (Traub) is still an evergreen red worthy of use in the South.

The new 'Irish Ice' (Reckamp) seems to be a real addition to the greenish yellows, the finest of which should include 'Irish Limerick', 'Erin Prairie' (Fay); 'Galena Moon' (Blocher). In the Buck garden 'Mary Todd' (Fay) is still the best performer in its color.

Treated 'Tai Pan' (Moldovan) was most prodigal in bloom, and the treated 'Fuchsia Flame' (Hardy) was electric in brilliance of color. 'Chicago Two Bits', 'Chicago Thistle', 'Chicago Lavender Lace' and 'Chicago Frost', four outstanding introductions from James E. Marsh, were extraordinary improvements over the early lavenders and purples

such as 'Royal Favor' (Taylor-1959) and 'Miss Jessie' (Hardy-1956), which at that time were quite advanced. The Buck seedlings out of treated 'Little Wart' (Spalding) gave an amazing range of delightful miniatures; one lavender and cream bicolor was quite superior, several clones were of a distinct lavender blue, and a good performer was pale pink with faint eye. These will be watched most carefully as the beginning of an important line of tetraploid miniatures. Among the large flowered tetraploid seedling there were some very handsome pinks, corals, reds, and purples.

Among important new developments in daylily breeding is the lengthening of the flowering season of individual clones, as seen in the work of Wm. R. Munson, Jr., whose 'King's Cloak' has been the progenitor of many repeat-blooming evergreen clones which retain much of its capacity for sending up new spikes in seccession. The Munson selections have been chosen carefully for good branching, healthy vigor, plant habit, and color, and line breeding has given a whole series of marvelous clones, most of them evergreen. Line breeding is responsible for the superior results in the Fay and Blocher seedlings, as well as in the Peck, Childs, Reckamp, and Benzinger work.

An optimistic outlook for future developments in the daylily seems assured. Interest is being sustained in the older daylily areas of the country, and it seems finally to be gaining in the West. New and important breeders and researchers are appearing all over the country. Let us hope that the daylilies can go forward in spite of social upheavals and problems.

1975 REPORT

The weather during 1975 again was a powerful and unpredictable control over season and performance of our daylilies. The West had a cool, and late, season while the South had a fairly normal succession of flowering. The Midwest in some areas was quite dry, resulting in very few flowers for the National Convention in July of the American Hemerocallis Society in Avon, Ohio.

Southern California's daylilies began blooming so late that there were fewer to choose from for exhibition at the Southern California Hemerocallis and Amaryllis Society's annual Daylily Show at Descanso Gardens on June 8th, but a fine display was achieved with the material available. The show of the Southwest Hemerocallis Society in Escondido, California, on June 14th was filled with fine named varieties and many beautiful seedlings from its members.

Among yellow varieties observed in the Buck garden this year 'Mary Todd' (Fay) was still a best performer, being joined by Dr. Peck's 'Florence Byrd' and 'Royal Kin' and the Fay 'Irish Limerick' and 'Erin Prairie'. 'Yellow Crystal' (Griesbach) was a large, tall yellow of great substance, but the paler 'Galena Moon' (Blocher) had better branching, shape, and fertility. Treated 'Beth Standard' (Standard) was very fine and seemed to offer much for breeding. 'White Wings' (MacMillan), 'Robert Way Schlumpf' (MacMillan), and 'White

Frost' (Gore), in treated forms, were great additions to breeding material. 'Bengaleer' (Peck) was a wonderfully branched yellow-orange, but it faded badly. Better sunfastness was seen in 'Golden Prize' (Peck).

'Mary Moldovan' (Moldovan) was still the best melon grown, its only fault being that it is too slow of increase. The treated 'Frances Fay' (Fay) again produced a marvelous show of flowers and set many pods. The new 'Chief Sequoia' and 'Terra' (Fay) were huge low-growing melons of great quality. 'Seed Setter' (Hardy) had many spikes and set pods readily. 'Harvy Randall' (Fay) is still an exceptionally well branched pale yellow melon, and it was better than 'Cream Sachet' (Reckamp), which is of later introduction and of very similar color. 'Ivory Marble' (Munson) and 'Parian China' (Reckamp) both had tremendous substance and fine shape, making them desirable as parents.

'Dancing Shiva' (Moldovan) in its second year had perhaps the most beautiful flowers of any of the pinks grown, but it was weak on performance. 'Pink China' (Hardy) was again an excellent performer. 'Shell Pink' (Fay) made an unbelievable showing and was better than it had ever been. 'Tetra Pink Lightning' (Hall-Lachman) was a wonderful addition to breeding material.

'Cherry Cheeks' (Peck) was still the most beautiful dark rose pink grown; clear, clean color was also shown by 'Domani' (Munson). 'Jock Randall' (Peck) unquestionably was the best rose colored variety grown, but treated 'Beauty Bright' (Lester) may lead to roses of equal color quality. 'Cherry Chin' (Peck) is very lovely in its deep rose color, but it is deficient in shape. 'Wine Bold' (Peck), 'Bold Baron' (Peck) and 'Embassy' (Munson) are good wine colors, but the latter faded badly here. 'Fantastic Dream' (Brown) was a disappointing wine color of good shape; we are hoping for improvement in both color and performance in an established clump.

Among the lavenders and purples grown, all of the Marsh introductions were excellent; 'Chicago Two Bits' was the largest and clearest in color, while 'Chicago Thistle' was by far the best performer and best pod setter; 'Chicago Regal' was amazingly better than ever before. 'Aberdeen', 'Helen Boehm', and 'Cloverdale' were three of Dr. Peck's new 'Catherine Woodberry' hybrids that were most delightful. 'Northbrook Wine' (Fay) was a clear lavender-purple of low height; it should be very useful for breeding. An induced tetraploid form of 'Silver Shadows' (Munson) was a strange clear lavender over a pale yellow-green ground, and it will be used in breeding.

Among the reds best performers were the Peck varieties 'Sir Patrick Spens', 'Lusty Lealand', and 'Douglas Dale'. 'Johnny Ward' (Fay) is a vigorous low growing red that should be widely used. The taller Griesbach reds 'Gypsy Trail' and 'Joey Langdon' were excellent performers.

The most exciting eyed varieties grown were 'Bishops Crest' (Munson), a lavender pink with purple eye that reblooms wonderfully; and 'Tetra Borgia', an induced form of the well known Robert Baker Wynne

'Borgia', which produced such a fantastic range of colors in the Wynne seedlings.

The best miniatures grown were the offspring of treated 'Little Wart' (Spalding); these ranged from pale pink to dark lavender purple. Treated 'Little Emily' (Hardy), a tall, many flowered yellow, and the treated 'Double Pace' (Wynne), a bronzy red double multiflora, were two others that carried many seed pods from tetraploid crosses.

Other Buck seedlings that got special attention in 1975 were several eyed ones out of 'Jock Randall', and some excellent pinks and roses.

1975 gave much pleasure to the true daylily aficionados.

U. S. DEPARTMENT OF AGRICULTURE RELOCATES ITS PLANT PERMIT OFFICE

WASHINGTON, Oct. 1—Travelers or importers wishing to bring foreign plants, soil, or plant products (fruit or vegetables) into the United States now must send their applications for federal permits to a new address.

After 30 years in Hoboken, N. J., the five-person permit-issuing office of the U.S. Department of Agriculture (USDA) has moved to Hyattsville, Md. The move consolidates manpower and record-keeping at Hyattsville.

James O. Lee, deputy administrator of USDA's Animal and Plant Health Inspection Service, explained that permits are required under federal regulations designed to protect America's plant life from destructive foreign plant insects and diseases.

"To prevent loss of their property at U.S. ports of entry, persons intending to import soil and plant products should find out in advance whether a permit is required, and the other conditions of entry," Mr. Lee cautioned.

For information and permits, write to: Permit Unit; U. S. Dept. of Agric., APHIS, PPQ; Federal Building, Rm. 638; Hyattsville, Md. 20782.

AMARYLLIS VIRUS-RESISTANCE INVESTIGATION

WILLIAM D. BELL, *Miami, Florida*

Viruses of *Amaryllis* are problems, but there may be a solution if we can find resistence to viral infection. Unfortunately, there is currently no easy cure except to isolate healthy amaryllis from infected plants. However, remission of the visible virus symptoms can occur to some extent under varied cultural conditions, and proving virus absence often requires examination with an electron microscope and/or other means. There is strong evidence that seed-grown plants are

virus-free, and the disease unually does not appear to infect plants in their native habitats, unless exposed to diseased cultivated plants.

Virus resistence has been found in other plants with problems similar to amaryllis. Thus, it seems reasonable that among the many species in the genus *Amaryllis,* there may be some which have a natural resistence. So we ask for help in obtaining seeds of *Amaryllis* species or species hybrids from diverse locations. *Seeds, but not bulbs or offsets,* are also of interest from hybrids which do not display virus symptoms when grown among infected plants. Floral type or quality is not of importance at this point. It is necessary to limit this request to seeds since plants will be started in an isolated plot and growing plants might introduce one or more viruses into the test plants.

Dr. F. W. Zettler is a plant pathologist at the University of Florida, Gainesville, with a personal interest in amaryllis. He is propagating these plants at his home for eventual testing for virus susceptibility. Hopefully, this request will result in his obtaining a diverse collection of germ plasm, some of which are resistant to one or more of the amaryllis viruses. Eventually, it may be possible to incorporate this resistance through selective breeding into some of the more attractive—but susceptible—cultivars of amaryllis.

Please send seeds suitable for this investigation to:

Dr. F. W. Zettler
31 Grassy Lake Road
Archer, Florida 32618

GRAVEL-TOP AMARYLLIS CULTURE

Richard E. Tisch, *20516 Clark St.,*
Woodland Hills, Calif. 91364

Planting my *Amaryllis* bulbs in gravel-topped soil has improved their growth, reduced losses to insect damage and fungus rot, and dramatically diminished the incidence of "red spot" infestation. The net result has been better flowering: taller, stronger scapes; larger, brighter flowers; earlier maturation of bulbs; more and healthier offsets.

Simply, my latest method is the use of a layer of mixed 3/4 inch crushed gravel and pea gravel, under and around the bulbs, whose roots are down into a standard Amaryllis soil mix. It works equally well in pots or in outdoor beds. All my potted plants have now been converted to this system, which started out as a desparate measure in my "sick bay" in the screenhouse. It came as a result or hauling out and rereading back copies of Plant Life.

—When I had some plants which were steadily declining, I spent many hours going back through my records to see if there was a clue in my notes! None! Then, as is my custom, I thumbed through my Plant Life volumes. Gradually there came to me a concept of the natural conditions under which so many collectors have found *Amaryllis* growing in their native habitat. Frequently it was implied,

and sometimes specifically stated that they were found growing in a loose "screed" type fall-off from rocky structure, with their roots in the rich humous that had accumulated as rains washed down through the loose topping. In some cases it was mentioned that they grew on rocky ledges, in the debris which had gathered there over the years.

My first patient was a prized *A. belladonna*, collected in Peru and graciously sent to me by the collector. It had arrived with an exceptionally extensive root mass growing from large strong bulbs. It had flourished and flowered repeatedly for two years, then had suddenly shown a noticeable decline in leaf growth and had stopped flowering. Shortly after replanting it with gravel under and around the bulb it reacted favorably and started growing and flowering again in its characteristic happy fashion. So, with renewed faith as a healer of sorts, I looked around for more patients. They were readily at hand, and numerous.

I went through all the potted seedlings and specimen plants on the screenhouse benches, and then took on the outdoor beds—save one, which was used as the test bed. Sure enough, that unchanged bed was the one which had much red spot, with twisted scapes that never brought their flowers to blossom, and with mushy bulbs which dwindled away into complete disappearance. The other beds put on a show which was an almost startling advance over that of previous years.

These successes have led me into trying the same planting scheme on other Amaryllids. My *Sprekelia* have been first, being mostly in pots and tubs so that they can be brought inside to more warmth during the winter cold stretches. They are flowering now, one after another, with larger, brighter blooms. This is the one thing I do not understand: why are most of the flowers noticeably larger and brighter in color? Regardless of the reason, I am now getting ready to replant the "test" bed bulbs in this same manner, to see if they change for the better. More bulbs will be put in oversized pots and in tubs; these seemed to show the greatest improvement over bulbs planted in pots with the soil directly under and around the bulbs.

Some experimental bulb plantings, in which I used only pea gravel or finer crushed rock, have not done so well. They have shown improvement, but not so marked as those plantings which used the crushed rock—pea gravel combination, or which used only crushed rock. Parallel to this, there were some experimental plantings of bulb cuttings and seedling bulbs directly into gravel only, with no soil underneath, watering them with hydroponic growing solution. These prospered, but did not show enough difference to warrant expansion of the use of that method, or even continuation of its use on the experimental plants. Since having replanted in gravel with their roots in soil, they look and act just as happy.

I must conclude, therefore, that planting *Amaryllis* bulbs with their roots in soil, but with gravel under the bulb and around it, results in superior plant growth.

PLANT LIFE LIBRARY—continued from page 92.

into the wonders of plant growth. The author presents 20 additional projects for children, and she is to be complimented for her foresight since the dividends from such early contact with living things will direct the energies of the child in the right direction for a proper regard for all living things. Such a child would naturally be interested in nature and its energies could easily be guided into the proper channels. Every household with children should have a copy of this book. The wholesome dividends from it are incalulable. Very highly recommended.

NATURE, CHILDREN AND YOU, by Paul E. Goff. Exposition Press, 900 So. Oyster Bay Rd., Hicksville, N. Y. 11801. 1974. The author explains why he became a naturalist, and points out that nature interpretation is common sense. He lists a great many projects that could be brought to the attention of children and thus to direct their energies to nature appreciation, including the life cycle of the forest, mounds in the woods, craters in the forest floor, how a tree grows, the log as a recycling station, squeezing dead wood, the skin of a tree, hollow trees, a tree as an apartment house, etc., etc., etc. This is another book which should be in the home with growing children so that the parents may direct the energies of their offspring toward nature appreciation. Very highly recommended.

MARINE AQUARIUM FISH IDENTIFIER, by Wilbert Neugebauer, and edited by Braz Walker. Sterling Publ. Co., 419 Park Av., New York 10016. New trade edition, 1975. Pp. 256. Illus. $4.95.—Originally written by Wilbert Neugebauer in Stuttgart, Germany, 20 years ago, translated by Manly Banister, and adapted by Braz Walker, a Texan and authority on tropical fishes, this attractive text should appeal to those interested in salt water fishes. Following the brief introduction, glossary and black-and-white illustrations of the general marine fish groups, twenty-seven species are illustrated in color, and described. For each species illustrated, the family, scientific and popular names are given; the distribution and habitat are indicated, and the species is described; the length is noted and brief comments made. Scientific name and general indices complete the volume. Recommended for all interested in marine fishes.

THE SIAMESE FIGHTING FISH: ITS LIFE CYCLE, by William White, Jr. Sterling Publ. Co., 419 Park Av. So., New York 10016. 1975. Pp. 60. Illus. $5.95.—Subtitled "Betta and Paradise Fish", this attractive book, profusely illustrated in color, is of especial interest for these fishes show an intermediate evolutionary stage from fishes to land animals. They not only use gills to rake oxygen from water, but also have an accessory breathing organ or "labyrinth" which allows them to surface and take in atmospheric oxygen directly. The four sections of the book are devoted to the anatomy, behavior, breeding and ecology of these unusual fishes. The index completes the volume. Highly recommended to all interested in biology.

FLOWERS OF THE MOUNTAIN COUNTRY, by Stanley L. Welsh and Bill Ratcliffe. Brigham Young University Press, Provo, Utah 84602. 1975. Pp. i-xx + 83. Illus. cloth, $8.95; paperback, $5.95.—This "representative sampling" of the mountain wild flowers of the western United States and Canada includes no less than 118 breath-takingly beautiful color plates. These alone are worth more than the price of the book. After the **introductory** sections on using the book, and a survey of **Mountain Country**, with beautiful scenes in color, the rest of the book with many colorful illustrations is divided into four parts, according to colors; which is to simplify identifying collected flowers: Part 1, flowers white; Part 2, flowers pink, to red; Part 3, flowers yellow to orange; and Part 4, flowers blue to purple. An index completes the volume. Very highly recommended to all for there is surely none who would not be thrilled with the utterly beautiful wild flowers.

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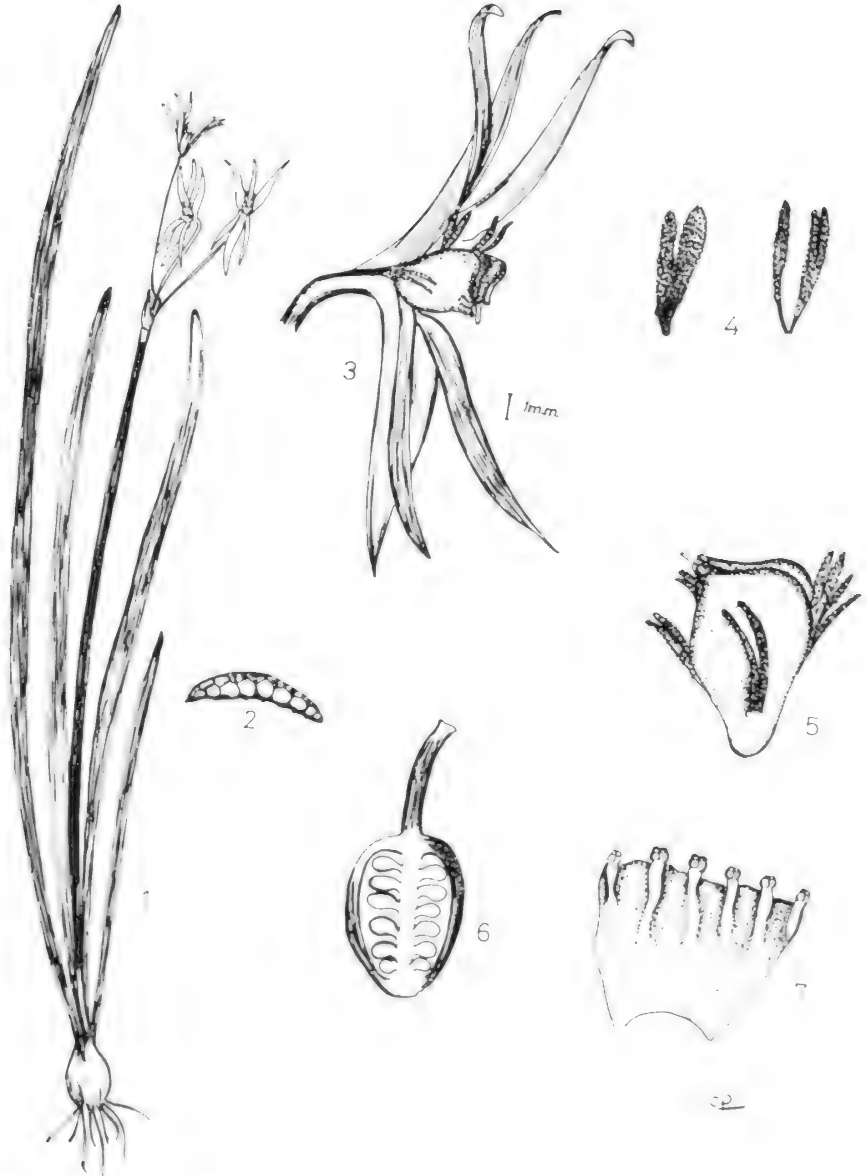

Fig. 24. **Miersia chilensis** Lindl. **1.** the entire plant; **2.** cross-section of leaf, **3.** flower, **4.** ligules, **5.** ovary with ligules and stamens, **6.** cross-section of ovary, and **7.** stamens.

MIERSIA CHILENSIS LINDLEY

Consuelo del Poso and Otto Zoellner,
Catholic University, Valparaiso, Chile

The climate of Central Chile is characterized by its rainy winters and dry summers and these are the conditions which Amaryllidaceae prefer for growing and flowering. So in Spring time the Chilean

Fig. 25. Mitotic metaphase chromosomes from root-tip cell of **Miersia chilensis**, 2n—12. **Upper, and lower left**, one squashed cell showing the 12 chromosomes. **Lower right**, types of chromosomes. **m**, metacentric, **s**, submetacentric, and **t**, telocentric. Note in extreme upper left corner that the engraver has cut off tips of one **t**. chromosome. For whole chromosome see t-1 in lower right corner.

mountains, hills and plains are in flame with the flowers of many bulbous plants: the brillant red Rhodophialas and Phycellas, the red striped Placeas, the white Nothoscordum, Leucocoryne and Chrysocoryne, the greenish purple Tristagma and many more.

But there is one tribe of Amaryllid plants, very different from all of these mentioned above, it is the Tribe Gilliesieae. The specimens of these monotypical Chilean plants may never awake interest in gardeners and plant-lovers in cultivating them, nor may the representatives of Gilliesieae ever be seen in flower expositions. These little plants are small, modest, they flower in the earliest days of Spring (*Miersia* can be found at the beginning of winter season). They prefer shadowy places and their small flowers have green tepalsegs. Only a watchful observer will discover these small, generally zygomorphic flowers between tall green grasses and leaves.

DESCRIPTION OF **MIERSIA CHILENSIS LINDLEY**, FIG. 24

Bulb small, tunicated formed like a pear, 1.6—1.8 cm high, 1—1.3 cm wide. Aerial parts of plant 15 - 20 cm high, with 3 or 4 leaves, leaves bright green, linear nerves, contemporaneous with flowers. *Scape* cylindric, from 7—16 cm high. Spathe 2-valved, lanceolate greenish. Umbel with 4 or 5 flowers, pedicels subequal. *Flowers* with 6 green tepalsegs (3+3), setepalsegs lanceolated 0.8—1 cm long and 0.2 cm wide. The petepalsegs 0.6—0.8 cm long and 0.15 cm wide. *Stamens*, 6 their filaments joined, forming a staminal tube which surrounds the ovary. *Ligules* (or paraperigone) 6 very small scales inserted on the side of the *staminal tube*, bifid, 3 mm long, 0.5 mm wide, ligules purple coloured. *Style*, short, 2 mm long, *stigma* capitate.

Miersia chilensis flowers from June till August; during the winter months. It grows in shadowy places, the plants always stand in thick groups of 10—50 bulbs. Carlos Reiche who studied this group of alliaceous plants wrote that *Miersia* is self-pollinated because the flowers appear in cold rainy wintertime and grow only in shadowy places where no insect will look for them. They are odorless and of greenish color and in no way attractive. *Miersia* develops ripe fruits and seeds, but plants multiply also vegetatively.

Miersia chilensis Lindley, 2n=12 chromosomes. Fig. 25

The caryotype of *Miersia chilensis* is as follows:

4 pairs, *m*, metacentric
1 pair, *s*, submetacentric
1 pair, *t*, telocentric

The bulbs used in this investigation were collected in the valley of Marga-Marga, Province Valparaiso, Chile, in June 1973, and the entire plant was dried and preserved in the Herbarium of the Catholic University of Valparaiso as a voucher specimen.

MIERSIA CHILENSIS—Poso & Zoellner, continued on page 57.

Leucocrinum montanum Nuttall

L. S. Hannibal, *4008 Villa Court, Fair Oaks, California 95628*

L. H. Bailey in his *Cyclopedia of Horticulture* describes *Leucocrinum montanum* as a possible garden bulb and lists the source as western United States. Inquiries by the writer some thirty years back brought vague replies concerning the plant or its habitat. No one seemed to know it. Thus when we first encountered the plant in flower along a little traveled dirt road in the subalpine desert area well east of Mount Lassen, California, I failed to recognize it. Obviously the snow white blossoms growing near flush with the ground were

Fig. 26. **Leucocrinum montanum** Nuttall, 15 miles north of Eagle Lake, California. **Left**, a single clump; **right**, showing natural spacing (see text).

Liliaceous in form, but the plant lacked an enlarged bulb, had a fibrous root system and bore blossoms with inferior ovaries whose pedicels came directly from the basal plate. There was no scape or umbel. Was it *Amaryllidaceae* or what?

I took several samples to key the plant out. According to W. L. Jepsen's *Flowering Plants of California* it was *Leucocrinum montanum* but Jepsen, Munz and Bailey all indicated it was Liliaceous while J. Hutchinson suggested borderline. No references mentioned the inferior ovaries to the blossoms or that the flower buds emerged from the basal plate. Did it actually have an umbel imbedded in the basal plate?

How could it relate to *Hemerocallis or Hesperocallis?* How rare was it and could it be grown in the garden or not?

I needed more material and some idea of its growth habits and requirements, but it was several years before I could return to the area where I first found the plant ten miles north and north-west of Eagle Lake in Lassen County. To find the flowers out in their prime one had to be there shortly after the snow was off the ground, preferably in mid May. June would be too late. In Harvey Valley, Little Harvey Valley and the Champs Flat area the plants cover hundreds of acres of open level meadow land. The bulbs seem to prefer a loamy volcanic soil which has been loosened by frost heave. Usually the water table, developed by melting snow, is less than two feet below the roots. Normally dwarf sage and other alpine plants are common associates, as are lava boulders and scree. Plant densities often reached 20 or more plants to a square meter. The spacing is unusually uniform as no plants grow with overlapping root systems. The greatest population densities were found at 6200 feet elevation, none were found below 5500 feet.

As stated, the plants have no apparent bulb. The ten to twenty short linear leaves are completely sheathed below ground level and this sheathing terminates at the basal plate some two to three inches down. The radial root system spreads horizontally forming a circle five to eight inches in diameter. Cattle or deer will not touch the plants. The blossoms flower without a trace of a scape; the pedicels and bracts arise as a cluster directly from the basal plate. All are well enclosed within the older leaf bundle. By removing the latter one finds the pedicels ranging from 2 to 20 mm. in length, depending upon the age of the blossom. The ovary is inferior and the major portion of the tepal tube is also enclosed within the leaf sheathing. Obviously, as the seed ripen the pedicels elongate such that the seed can scatter on the ground. Plant increase also occurs by bulb splitting and offsets, but once detached they seem to be exterminated by the parent plant.

Apparently few botanists get to see *L. montanum* since it flowers three or four weeks after the snow is off these subalpine meadows. Attempts to grow the plants at lower elevations, even in their own soil has been unsuccessful. They have a very restrictive ecological zone which appears to lie along the extreme eastern fringe of the *Pinus ponderosa* belt. They require full sun, a loose, moist, slightly alkaline, volcanic soil, a 6500 foot elevation with freezing winters and cold nights, and a ground water level only a few inches below the roots. In no instance were plants found on sloping ground more than a foot or two above a ditch or stream. *The plant's toxic enzymes kill all grasses, sages and other competing plants.* Some variability was noted in flower size and tepal width. Colonies reported in the adjacent counties of Modoc, Sierra and Siskiyou have not been checked out, but these colonies north of Eagle Lake do not extend over a width greater than ten miles and definitely not east of Highway 395 since the California-Nevada desert is too dry in this portion. The plant has been reported as growing about the Rocky Mountains (Marriage, 1941) and eastward into Nebraska where Nuttall found it in 1810.

From the evolutionary standpoint the *Leucocrinum* is quite unique and extremely primitive. Its inferior ovary suggests that this feature predates the formation of a scape or umbel. We therefore have difficulty associating it with *Hemerocallis* or other genera having superior ovaries. All features point up a strict adaptation for subalpine conditions. In some respects *Leucocrinum* resembles *Romulea nivilis* on Mt. Hermon in Israel but only by parallel evolutionary development due to similar climates and exposure. *Leucocrinum's* winter hardiness can only be approached by *Narcissus* and a few Andean bulbs. We can only surmise that *Leucocrinum's* preservation through the ages has been its ability to retain its territorial areas against competing plants by its toxic enzymes. Its great age is also borne out by it being found in the eastern Rocky Mountain area as well as north-eastern California with no known colonies between. Distribution under such restricted ecological requirements probably predates the more recent ice ages. One has to see the plants growing in the wild to appreciate how exacting its requirements are or how effective its enzymes are in preserving its territorial imperative status. Under the circumstances it is not a potental garden bulb and M. Cave's work shows that *Leucocrinum* is quite *remotely* related to both *Hesperocallis* and *Hemerocallis*.

We wish to thank Dr. J. Madison, University of California at Davis for his comments concerning the Alpine hemicryptophytic features exhibited by *L. montanum*. In his opinion the inferior ovary does not necessarily indicate close relationship with the *Amaryllidaceae* either.

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SAPONINS DOUBTFUL IN **LEUCOCRINUM MONTANUM**

Hamilton P. Traub

In early July 1975, Mr. L. S. Hannibal of Fair Oaks, Calif., kindly sent samples of *Leucocrinum montanum* (past the flowering stage), collected in Lassen County, Calif.

The descriptions of this plant in the literature are incomplete in

some of the characters and it is for this reason that these are recorded here: The leaves were no longer in prime condition, but the seed capsules at the base of the leaves had ripened which made it possible to describe these: fruit a trilocular whitish capsule, approx. 7 mm. long, 5 mm. in diam. The seeds did not set equally in the locules, ranging from 1-1-0, 1-1-1, 2-1-1, 2-2-1, 3-1-0 and 3-1-1. They were small, black, approx. 3 mm. long, 2 mm. in diam.

TEST FOR SAPONINS

The main purpose for sending the plant samples was to obtain a preliminary test for saponins. This was carried out on the leaves, not in their prime; and the roots, in their prime, according to the stable-foam test as described earlier (Traub, 1975). The results are given in Table 1.

Table 1. Testing for sterodial saponins by the stable foam method (Traub, 1975).

Species	Order	Depth, ml. stable foam [1]	Presence of Saponins
Beschornerea sp.	Agavales	Leaves 4.00+	positive
Amaryllis divifrancisci	Amaryllidales	Leaves 0.00	negative
Leucocrinum montanum	Liliales	Leaves [2] 0.25	doubtful
		Roots 1.00	doubtful

[1] A stable foam of 2.00 cm. or more is considered to be positive for sterodial saponins, and lesser amounts, remaining after the 5 minute interval, is considered as doubtful.
[2] Not in prime condition.

Apparently a more refined method of analysis is required to determine if minor amounts of saponins are present in *Leucocrinum montanum*. This species is therefore considered as belonging in the Order Liliales pending more refined analyses.

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TRIBE **GILLIESIEAE**, FAMILY **ALLIACEAE**, ORDER **ALLIALES**

HAMILTON P. TRAUB

The Tribe Gilliesieae has been reviewed by Reiche (1883) who placed it under the Liliaceae. Hutchinson (1934, 1939) classed it with the Amaryllidaceae, and Traub (1963, 1970) accepted this placement. However, recent research has caused him to group it as a tribe under the Family Alliaceae in the New Order Alliales (Traub, 1972).

The writer can recall no other group of plants in which the characteristics on first examination appear so scrambled as in the Tribe Gilliesieae. The generic descriptions resemble a botanical crazy quilt. However, on closer study, a consistent evolutionary trend, from *free stamens* in *two* genera to a union of the stamen filaments below into a *staminal tube* in *seven* genera, is revealed.

Although there is evolution from *free tepals* to a union below into

a *tepaltube*, and *tepalsegs* above, and again from 6 tepals or tepalsegs to 5 or 3; from 6 to 3 or 2 fertile stamens, and from the entire to the 3-parted stigma, in some species, these are more or less secondary lines of change, and appear to be more or less random. They may or may not overlap with the two main lines of evolution within the Tribe. Other characters are of a similar nature.

The following Key (Table 1) to the subtribes and genera of the Tribe Gilliesieae, devised in 1965, is presented now in the hope that it may stimulate interested workers to publish their results on this subject.

TABLE 1. Key to Subtribes and Genera of the Tribe **Gilliesieae** Lindl., Family **Alliaceae**, Order **Alliales**.

TRIBE **GILLIESIEAE LINDL.**

1a. Flowers with **stamen-filaments free**; floral segments united below into a short **tepaltube**, with 6 **tepalsegs** above; fertile stamens 3, staminodes 3:

SUBTRIBE 1. **SOLARIINAE** Traub, **Subtrib. nov.**

Flores filamentis staminum libris. Typus: Genus **Solaria** R. A. Phil., in Linnaea **29**: 72. 1857.

2a. Leaf solitary, linear, umbel 3—4-flowered. (Chile) .... 1. **Solaria**
2b. Leaves 3, umbel-several-flowered. (Chile) .... 2. **Erinna**

1b. Flowers with stamen-filaments united below into a **staminal tube**:

SUBTRIBE 2. **GILLIESIINAE** Traub, **subtrib. nov.**

Flores filamentis staminum infra in tubum staminalem connatis.
Typus: Genus **Gilliesia** Lindl. in Bot. Reg. t. 992. 1826.

3a. Tepals or tepalsegs 6 or 5:

4a. Floral segments free; with or without **scales** at the base of, or adnate to, the staminal tube:

5a. Without scales at the base of the stamens or adnate to them; tepals 6, fertile stamens 6, stigma 3-lobed; umbel 1-flowered (Chile) .... 3. **Speea**
5b. With scales at the base of, or adnate to, the staminal tube; umbel 4- or more-flowered:

6a. Fertile stamens 6, staminal tube oblique urn-shaped; tepals 6. (Chile) .... 4. **Miersia**
6b. Fertile stamens 3, staminodes 3:

7a. Leaves very large, to 5 ft. tepalsegs 6. (Chile) .... 5. **Gethyum**
7b. Leaves much smaller, tepalsegs 6 or 5; style trifid. (Chile .... 6. **Gilliesia**

4b. Floral segments united below into a campanulate tepaltube 6 tepalsegs above; fertile stamens 2; staminode (filament only) 1; umbel several-flowered. (Chile) .... 7. **Ancrumia**

3b. Tepalsegs 3, free or nearly so; umbel 1—5-flowered:

8a. Tepalsegs entirely free; fertile stamens 6; style entire; umbel 1—2-flowered. (Argentina) .... 8. **Schickendantziella**
8b. Tepalsegs nearly free, staminal tube irregularly split above into 6 lobes, usually only 3 lobes bearing anthers; stigma 3-ligulate; umbel 5-flowered. (Peru) .... 9. **Trichlora**

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IN CHINA'S BORDER PROVINCES—THE TURBULENT CAREER OF JOSEPH ROCK BOTANIST-EXPLORER, by S. B. Sutton. Hastings House, Publishers, New York. 1974. 334# pp., illus. $9.95. Botanical explorers, like surfers, and other rugged individualists are a different breed of cats from their conventional fellows in our Society. If anyone doubts this statement he should read Sutton's biography of Joseph Rock. As depicted by Sutton, Rock emerges as a unique but fascinating character with a great diversity of interests and an insatiable ego. Rock is well known in botanical circles for his work as a collector in China and Tibet. He made a number of trips to these areas from about 1920 until 1949. As a botanical collector, he never achieved the status of such well known figures as E. H. Wilson, Kingdon Ward, Fortune, Douglas, and others; much to his disgust. However, his knowledge of, and feeling for, the obscure native tribes that inhabit the little known borders of China and Tibet has never been excelled. At his death, he left a quantity of diaries, reports, letters, and an unpublished manuscript. By skillfully combining these materials along with interviews of several of Rock's relatives and contemporaries, Sutton has given us an interesting biography of one of the most unique botanists of our time. His explorations were financed by the National Geographic Society, the Arnold Arboretum of Harvard University, the U. S. Department of Agriculture, the U. S. Natural History Museum, and his own resources.

This book was a disappointment to me, because it barely touches on the botany of the regions explored by Rock, nor does it even assess or mention the importance of Rock's horticultural contributions to our homes and gardens. Perhaps Sutton is reserving an account of Rock's botanical exploits for a future book, we hope so.—**Thomas W. Whitaker.**

A FIFTH SUMMARY OF THE VERBENACEAE, AVENNIACEAE, STILBACEAE, DICRASTYLIDACEAE, STYMPHOREMACEAE, NYCTANTHANACEAE, AND ERIOCAULACEAE OF THE WORLD AS TO VALID TAXA, GEOGRAPHIC DISTRIBUTION, AND SYNONOMY. 2 vols. by Harold N. Moldenke. Publ. by the author, Dept. of Biol. Sciences, William Paterson College of New Jersey, Wayne, N. J. 07470. Copyright 1971. Pp. 974. Paper bound.

This fifth summary of the **Verbenaceae** and related families by Dr. Moldenke ranks among the monumental research projects in the field of taxonomy. The text is concerned with the geographic distribution; alphabetical lists of rejected and accepted names; a tentative dichotomous key to the families and other categories above the species level; rejected and doubtful records; a masterful statement of policies; an index of the habitat countries, Islands, etc. of the species and the subspecific entities; and an index of families, genera, species and subspecific entities. The volumes close with a statistical summary of names considered: 119 family and generic names, 5,146 specific and intraspecific names, 248 group names accepted, and 15,240 rejected names. A total of 20,753 names accounted for. Very highly recommended to all taxonomists.

SMITHSONIAN CONTRIBUTIONS TO BOTANY. In this numbered serial publication the Institution publishes original monographs dealing with various plant groups, which may be obtained from the Smithsonian Institution Press, Washington, D. C. 20402. **No. 18. THE GENUS APHELANDRA (ACANTHACEAE),** by Dieter C. Wasshausen. Pp. 157, 56 figures. 1975.—The history, palnology, and phytochemistry, of this group are considered. The genus **Aphelandra** and the 165 species are described in

detail. **No. 19. THE GENUS THRINAX (PALMAE: CORYPHOIDEAE),** by Robert W. Read. Pp. 98, 58 figures. 1975.—The history of the genus, the distribution and ecology, morphology, anatomy, cytology, and breeding behavior of these plants is considered. The Genus **Thrinax** and its four species are described in detail. **No. 20. FLORA MICRONESIA, 1: GYMNOSPERMAE,** by F. Raymond Fosberg and Marie-Helene Sachet. Pp. 15, 1 figure. 1975.—The scope and plan of the Flora is briefly outlined. Floristic taxonomic treatments, with keys, synonomy, descriptions, distribution, ethnobotany, etc., are provided for **Cycadaceae, Araucaridaceae, Podocarpaceae, Pinaceae, Taxodiaceae, Cupressaceae and Gnetaceae. No. 21. POLYNESIAN PLANT STUDIES 1-5,** by F. Raymond Fosberg and Marie-Helene Sachet. Pp. 25. 1975. In this pamphlet systematic, nomenclatural and distributional observations on various genera of Polynesian vascular plants, indigenous and exotic, and new species, varieties and nomenclatural combinations are recorded. **No. 24. FLORA MICRONESIA, 2: CASUARINACEAE, PIPERACEAE, AND MYRICACEAE,** by F. Raymond Fosberg and Marie-Helene Sachet. Pp. 28, 1 figure. 1975.—Gives systematic treatments, including descriptions, synonomy, pertinent literature references, keys, ethnobotany, citations, geographic records, and pertinent literature examined, of the families under study. **No. 26. A MONOGRAPH OF THE LICHEN GENUS RELICINA (PARMELIACEAE),** by Mason E. Hale, Jr. Pp. 32, 16 figures. 1975. A revision on the world level is presented for 24 species of **Relicina,** including 4 new species. **No. 28. A MONOGRAPH OF THE GENUS EPERUA (LEGUMINOSAE: CAESALPINIODEAE),** by Richard S. Cowan. Pp. 45, 13 figures. 1975.—A monographic treatment of the Genus **Eperua,** consisting of 18 species of which 4 are described as new. The gross morphology, leaf epidermis anatomy and palnology of most of the species are presented for the first time. These outstanding contributions are very highly recommended to all interested in plants.

COCONUTS, 2nd edition, by Reginald Child. Longmans. London. 1974. Imported by Humanities Press, Atlantic Highlands, N. J. 07716. Pp. 335. Illus. $30.00.—In this second edition of an outstanding text on coconuts, the subject is brought up to date after the lapse of a decade. After the consideration of the historical background and world areas and production, the botany of the plant and varieties, the text is concerned with climate and soils, selection and breeding, plantation establishment and care, nutrition and fertilizers, cultivation and maintenance, insect pests and diseases, the crop, and its commercial products, and research and information. Very highly recommended to botanists and those interested in the production of coconuts.

BIOLOGICAL SYSTEMATICS, by Herbert H. Ross. Addison-Wesley Publ. Co., Reading, Mass. 01867. 1974. Pp. 345. Illus.—It is refreshing to note that the aim of the author is to present the theory and practice of systematics simply and clearly. The author uses examples from animals, plants and bacteria whenever possible to give the student a well-rounded introduction to the subject. The subjects covered include a history of systematics, scientific interpretation. material basis of systematics, scientific reasoning, speciation, interpretation of living species, phylogeny, dispersal, ecological diversification, classification, and the future of systematics. A brief over-all modern classification of Superkingdom **Accellularae:** viruses, and Superkingdom **Cellularae:** Kingdom **Procaryotae**—Blue Green Algae and other autotrophic procaryotes and bacteria, and Kingdom **Eucaryotae,** plants, fungi and animals, should be added to the text. Very highly recommended to beginning students in biological systematics.

FLORA OF THE TEXAS COASTAL BEND, by Fred B. Jones. Rob & Bessie Welder Wildlife Foundation, P. O. Drawer 1400, Sinton, Texas 78387. 1975. Pp. i-xxxvi + 262. Illus.—This attractive book on the Flora of the Texas Coastal Bend is a pioneer guide to the wild flowers, shrubs, trees, vines and other wild plants within a radius of 30-60 miles of Corpus Christi, Texas. The introduction is concerned mainly with the using of

keys, the soils, climate, etc. of the region. This is followed by keys to the families, genera, and species, a listing, family by family, of all the native species (except grasses) with descriptions, preferred habitats, frequencies of occurrence and flowering periods. Highly recommended to outdoor nature lovers, conservationists, biology students, professional and amateur naturalists, park and wild life enthusiasts, agriculturalists and gardeners.

(THE FERNS OF JAPAN) ENUMERATIO PTERIDOPHYTARUM JAPONICUM: FILICALES, by Toshiyuki Nakaike. University of Tokyo Press. Imported by International Scholarly Book Services, P. O. Box 4347, Portland, Oregon. 1975. Pp. i-xiii + 375. $29.50.—Although the identification and classification of the ferns of Japan had been completed by previous workers, the descriptions are often imperfect, and thus the purpose of this attractive book is to clarify the taxonomic status, their nomenclature, geographical distribution, and history of research activities on each taxon. The ferns included are confined to the **Leptosporangiopsida**, and the geographical area concerned includes all the islands of Japan. Highly recommended to all interested in the ferns.

CONTROLLED ENVIRONMENT FOR PLANT RESEARCH, by Robert Jack Downs. Columbia University Press, 562 W. 113th St., New York 10025. 1975. Pp. (i-ix) + 175. Illus. $12.00.—The purpose of this timely book is "to describe the mechanical and biological system controlled environment facilities and to relate these systems to the problem of operation and plant growth." The subjects covered include the controlled-environment facility, conditioning systems for the major environmental parameters, environmental measurements, biological aspects of controlled-environment rooms, specifications for the plant growth chamber, and testing and maintenance of the plant-growth chamber. The useful information in five appendices and an index complete the volume. Very highly recommended to all plant scientists whose work requires the controlled-environment facility.

PHOTOSYNTHESIS, PHOTORESPIRATION AND PLANT PRODUCTIVITY. by Israel Zelich. Academic Press, 111 5th Av., New York 10003. 1971, 2nd edition 1973. Pp. i-xiv + 347. Illus. $21.00.—The purpose of this outstanding book is "to provide advanced undergraduates, graduate students, teachers and research workers in a number of disciplines with a perspective of photosynthesis **and how it can be increased."** The subjects covered include the morphology of leaf cells; chloroplasts and their various activities; photochemistry and photosynthetic electron transport; biochemical pathways of CO_2 fixation in photosynthesis; dark respiration and photorespiration; glycocate metabolism and the mechanism of photorespiration; photosynthesis as a diffusion process; environmental and physiological control of net photosynthesis in single leaves; and relation of photosynthesis to total respiration, and other factors to control of productivity in stands. Highly recommended to all students of plant physiology.

PLANTS IN THE LANDSCAPE, by Philip L. Carpenter, Theodore D. Walker, and Frederick O. Lanphear. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1975. Pp. viii + 534. Illus. $16.00.—This most attractive volume will serve as an adequate introduction to the principles and practice of ornamental horticulture in landscape architecture. The first section is concerned with the historical perspective, and present-day landscape industry. The second and third sections are devoted to the kinds of plants used in landscape design, the principles of plant ecology, plant classification, and landscape design. The following sections are concerned with the preparation and implementation of landscape plans, landscape construction, maintaining the landscape, and integrative landscaping. Indices of plant names and subject matter complete the volume. Very highly recommended to all interested in landscaping.

PLANT LIFE LIBRARY—continued on page [5].

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For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

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[A Committee of the American Plant Life Society]

[AMERICAN AMARYLLIS SOCIETY, continued from page 8.]

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This is required reading for every amaryllid enthusiast.

2. **DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893—1948**, by Norton, Stuntz, and Ballard. A total of 2695 Hemerocallis clones are included and also an interesting foreword, and explanatory section about naming daylilies. Manila covers; 100 pages (I—X; 1—90), includes a portrait of George Yeld. $5.00 postpaid.

3. THE GENERA OF AMARYLLIDACEAE, by Hamilton P. Traub. Includes a general introduction, a key to the subfamilies, infrafamilies, tribes, subtribes and genera of the Amaryllidaceae, and descriptions of all the genera. Every member of the Society should have this book for constant reference. Manila covers; publ. 1963; 85 pages. $7.00 postpaid.

4. LINEAGICS, by Hamilton P. Traub. This is the first outline text for the undergraduate student on the grouping of organisms into lineages. The text is divided into four parts: (a) the history of lineagics and lineagics as an integrated science; (b) basic lineagics, principles and procedures; (c) applied lineagics, principles and procedures; and (d) research methods in lineagics. Recommended for the student in biology. Publ. 1964. Manila covers, 163 pages, incl. 8 illus. $7.00 postpaid.

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PLANT LIFE

1977

AMARYLLIS
YEAR BOOK

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THE AMERICAN PLANT LIFE SOCIETY is organized for the "increase and diffusion of knowledge concerning plant life," and to carry out its objectives the main emphasis is placed on the publication of PLANT LIFE, the periodical devoted to plant life, incl. HERBERTIA, the yearbook devoted exclusively to the amaryllids, sponsored by the affiliated AMERICAN AMARYLLIS SOCIETY. The publications are international in scope. All paid up members are privileged to receive the current issues of PLANT LIFE, incl. HERBERTIA, THE AMARYLLIS YEARBOOK.

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All editorial correspondence should be addressed to: Dr. Hamilton P. Traub, *Editor, The American Plant Life Society, 2678 Prestwick Court, La Jolla, Calif. 92037.*

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PLANT LIFE

VOLUME 33

[Nos. 1-4, Jan., Apr., Jul. & Oct.]

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EDITED BY

Hamilton P. Traub

Thomas W. Whitaker

Harold N. Moldenke

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The cover features an electron microscope picture (X 51,500) of **Amaryllis** mosaic disease, showing numerous inclusion bodies visible in thin epidermis section of mosaic infested light green leaf strips. Note typical labeled **I** inclusion body at middle left center left. After Nowicki and Derrick, PLANT LIFE 1974, pp. 103-108.

PLANT LIFE, VOLUME 33, NO. 1, 1977—AMARYLLIS YEAR BOOK GENERAL AMARYLLID EDITION

PLANT LIFE, VOLUME 33, NOS. 2—4, INCL., 1977 GENERAL EDITION

ILLUSTRATIONS

CORRIGENDA

PLANT LIFE, Vol. 21, 1965, p. 96, under **Crinum amabile**, change **"cuperfolium"** to **"cuprefolium"**. PLANT LIFE, Vol. 31. 1975, p. 63, under **Crinum asiaticum**, change **"cuperfolium"** to **"cuprefolium"**.

PLANT LIFE, VOL. 33, NO. 1, January, 1977

AMARYLLIS
YEAR BOOK
1977

Year Book of

The American Amaryllis Society

44th Issue

General Amaryllid Edition

EDITED BY

Hamilton P. Traub

Thomas W. Whitaker

Harold N. Moldenke

THE AMERICAN PLANT LIFE SOCIETY

Box 150, La Jolla, California 92038

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For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

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A Committee of the American Plant Life Society

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(**AMERICAN AMARYLLIS SOCIETY,** continued on page 129.)

PREFACE

This 44th issue of THE AMARYLLIS YEAR BOOK is dedicated to Mrs. Emma D. Menninger, a great orchid fancier and breeder; who is famous as an outstanding *Nerine* breeder. Her large collection of *Nerine* hybrids has served as the basis for her extensive *Nerine* breeding in various flower colors. She is particularly famous for her white *Nerine* hybrids which are universally appreciated and sought after. She has also investigated the chromosomes of *Nerine* hybrids, and has published various articles in the *Nerine* field, particularly, her "Catalog of Hybrid *Nerine* Clones, 1882-1958" (see PLANT LIFE *16*: 63-74. 1960) which is always in great demand. She has served as Registrar of *Nerine* Hybrid clones for the American Plant Life Society in the past. For her outstanding contributions toward the advancement of *Nerine* breeding, including white hybrids, Mrs. Emma D. Menninger was awarded the William Herbert Medal for 1977, an honor richly deserved, by the Board of Directors of the American Plant Life Society.

We are sad to report the death of one of our outstanding members, William Quinn Buck, Herbert Medalist in 1969, who passed away suddenly on February 28, 1976. His friend, Frederick C. Boutin, was with him in his greenhouse collecting orchid pollen and making crosses and anticipating future crosses one evening and the next morning he had passed on—busy to the last in his life-long devotion to the improvement of cultivated plants. He always had a warm place in his heart for The American Plant Life Society; his sister had served as Secretary, and he was Chairman of the Daylily Committee. His two reports for 1975 and 1976 (see Vol. 32. 1976) were his last contributions; and unexpectedly, aside from his personal effects, he willed the residue of his property to the American Plant Life Society.

Again, we have a rich harvest of contributions to this issue of PLANT LIFE. Prof. Narain contributes a valuable article on the systematic position and taxonomic treatment of the Indian *Amaryllis* cultivars. Dr. William D. Bell writes about more potentials in *Amaryllis* breeding, Charles B. Ledgerwood describes how *Amaryllis* may be photographed in motion, and Dr. Cage writes about pot culture of *Amaryllis aglaiae*. Mrs. Jones describes her repeat-blooming *Amaryllis*.

Randell K. Bennett writes about two copper-colored Crinums, L. S. Hannibal reviews Verdoorn's paper on the Crinums of South Africa, and the need of *Crinum* seeds and bulbs for cancer research.

Donald D. Duncan writes about a variegated *Alstroemeria ligtu*, and describes a new *Alstroemeria* hybrid.

Mrs. Marcia Clint Wilson favors us with her annual report on the Zephyrantheae. Mr. Shields reports on *Hymenocallis* culture in Indiana. Dr. Zoellner describes the new Genus *Chrysocoryne*. Mr. Bauml reports on the Dr. Howard 1972 Mexican plant collecting trip, and Dr. Howard contributes brief accounts of his 1973 through 1976, Mexican plant collecting trips. There are reports on the annual Amaryllis shows, and still other interesting articles as shown by the

Table of Contents.

Contributors to the 1978 issue of the AMARYLLIS YEAR BOOK are requested to send their articles by August 1, 1977, in order to insure earlier publication of this edition. Unless articles are received on time, publication will again be delayed to June or July or even later as with some issues in the past. Your cooperation toward earlier publication will be greatly appreciated. *Those having color slides or transparencies which they wish to use as the basis of illustrations are requested to have black-and-white prints made, and to submit these with their articles.*

January 15, 1977,
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Hamilton P. Traub
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TRIBUTES TO WILLIAM QUINN BUCK, 1908-1976

A copy of the **Hemerocallis Register,** Spring, 1976, published by and for **Regions 7** (Arizona, California, and Nevada) **and 8** (Hawaii, Oregon and Washington) of **The American Hemerocallis Society,** has been received.

The main feature in this publication is an **In Memoriam** article with tributes from Mrs. Kenneth Boldt (Fullerton, Calif.), Frances Kuhs (Bakersfield, California), Dr. Hamilton P. Traub (La Jolla, Calif.), Jim Marsh (Chicago, Ill.) and Jack Romine (Calif.), Hubert C. Lloyd, (Monrovia, California), Joseph E. Werling and Gladys L. Williams, **(Southern California Hemerocallis and Amaryllis Society).**

Hubert C. Lloyd, of Monrovia, who co-authored with Hamilton P. Traub and W. Quinn Buck in producing **The Second Decade of Hemerocallis Washingtonia,** Jan. 1, 1959-Dec. 31, 1968 (PLANT LIFE 29: 124-140. 1973, in his tribute to Mr. Buck writes,—

About twenty years ago, I saw many daylilies in bloom at the Los Angeles State and County Arboretum in Arcadia and I asked at the gate house about them. I was told to see a Mr. Buck who worked there as head propagator. That was the beginning of years of visits with him at his home and at the Arboretum.

After his retirement, he devoted all of his time to hybridizing and growing new named varieties of daylilies and caring for a greenhouse filled with orchids and Amaryllis. It was a treat to see his seedlings bloom each year and my visits were more frequent then. He had many beautiful seedlings, some that he considered fine enough for further testing and eventual introduction.

The last time I visited him, a little over two weeks before his death, he said as I was leaving that he hoped to live to be one hundred years so as to see how much daylilies could be improved. How sad that he did not have a few years more.

DEDICATED TO
EMMA D. MENNINGER

HERBERT MEDALIST—EMMA D. MENNINGER

EMMA D. MENNINGER

AN AUTOBIOGRAPHY

I was born in Indiana in 1891, during the last days of horse-drawn street cars in our small town. The usual grade and high school days passed, and, as I had always aspired to be a teacher, I enrolled in a college course in the Indiana State Normal School. There, I was thrilled by taking all of the available courses in botany and zoology. Part of one of these courses required the collection of pressed plants with the proper herbarium sheets. Gathering weeds and wild flowers and preserving them, was an enjoyable task.

I taught for a few years in the local grade schools; the first was a one-room school with few pupils and eight grades. I surmise that I learned more that first year than any of my pupils!

In 1919, after World War 1, I moved to Los Angeles with my Mother and sisters. A year's course in Library Science with credit at the University of Southern California, led to a position in the Science Department of the Los Angeles Public Library. There, my work was pure joy.

Later, after my marriage to Elmore W. Menninger, whose work involved architectural research, I worked in Los Angeles as a high school librarian until my retirement in 1947.

My husband and I had both been charmed by the new cult of Cymbidium orchids. A number of these plants in full flower had been entrancingly displayed at the Bel Air and Pasadena flower shows. From that time on, horticulture became the main focus of our lives, embracing the culture of Nerines, Cattleyas, Cymbidiums, and tropical plants.

Both Nerines and Cymbidiums were nearly unobtainable in the United States during World War II. However, we imported both genera from England because greenhouses there were required to devote much of their space to food-bearing plants.

Over the years, we did extensive hybridizing and we learned to plant orchid seed asceptically. Most of this endeavor was my responsibility. Many of our hybrid Cymbidiums are registered by the Royal Horticultural Society in the name of Greenoaks.

By a rigorous process, and with the help of a fine microscope and a few published articles, I learned the technique of counting chromosomes in Nerines and Orchids. In Cymbidium species, the somatic chromosome number is 40.

In the genus Nerine, however, the somatic chromosome number varies from species to species. There are diploid numbers of 22, 23, and 24, as indicated in the article included in the Journal of the Royal Horticultural Society for October, 1951. Therefore, I found the chromosome numbers in Nerine hybrids difficult to determine. Most Nerine hybrids seem to be fertile. The only tetraploid Nerine was said to be 'Inchmery Kate', with 44 chromosomes. There is some doubt concerning this matter, and, in the few slides I had time to make using

root-tips of this variety, the count of 44 chromosomes was not verified. Using pollen of 'Inchmery Kate' to set seed on other varieties, is probably more successful than when trying to use 'Inchmery Kate' as the seed parent.

In Cymbidiums, triploids usually are not fertile, while most diploids and tetraploids are. When I started counting chromosomes, there were only three reported tetraploid Cymbidiums. I was able to find a dozen or more tetraploid Cymbidiums, including the fragrant tetraploid Early Bird 'Pacific,' to serve as a nucleus for breeding finer and early-flowering hybrids.

My husband and I made a number of trips around the world—to England, South Africa, and Southeast Asia. On some of these visits, we were delegates to various World Orchid Conferences. I became a member of the International Orchid Commission on Classification, Nomenclature, and Registration which usually met in conjunction with the World Orchid Conference.

During these visits to various countries, especially while in England, we added volumes to our horticultural library, such as a complete set of CURTIS'S BOTANICAL MAGAZINE, a run of the GARDENERS' CHRONICLE, a beautifully bound copy of Mrs. Loudon's ORNAMENTAL BULBOUS PLANTS and many other horticultural books. In 1955, in England, we photographed on film strips, all 509 original paintings of the Cymbidiums which had received awards from the Royal Horticultural Society.

Before 1952, we had imported South African bulbs from Kate Stanford and Nerines from England. In 1952, we purchased a duplicate collection of the Exbury Nerines from the Rothschild Estate. These were flowered out-of-doors in pots, and were later hybridized. By interbreeding the few white hybrids, we flowered a fairly large number of white seedlings. Of these, about 90% appear to be pure white, although certain clones, when grown in full sunlight, do develop a faint tinge of pink. During years past, the white seedlings were segregated in a small greenhouse, but they are now grown out-of-doors in pots, on benches.

A list of my favorite Nerine hybrids, would have to include the Exbury varieties 'Ben Hills' - cherry color, 'Susan' - pink, and 'Wisley Bridesmaid' - another pink. Among my own hybrids, 'Cimmerian' - dark, smoky fuschia, 'Firewheel' - flame, and 'Skyrocket' - tall, deep pink. But choosing favorites is difficult; Nerines are nearly all beautiful. Many colors are represented, including red, scarlet, blue, pink, coral, and white, with various combinations of these. So far as I know, there are no yellows or golds, although one could wish for Nerines in shades of gold such as that found in *Lycoris traubii.*

I have concluded that, while bees visit the Nerines for nectar, they do not disturb the pollen. A small fly—I believe it to be the bee-fly—does appear to pollinate the flowers.

In the early fifties, after my husband and I had both retired, we moved to seven oak-covered acres in Arcadia, California. We called our place, Greenoaks. My husband designed a small house, two large

glasshouses, and a shade house for the orchids. The Nerines were grown outdoors on benches. They were all grown in pots.

During these many years, I have enjoyed the pleasure of writing articles on Nerines for PLANT LIFE, including NERINES ARE BEAUTIFUL, 1959, CATALOG OF HYBRID NERINES, 1960, and BREEDING WHITE NERINES, 1973. Also, I have written on a variety of orchid subjects for the Orchid Review (England), American Orchid Society Bulletin, Cymbidium Society News, Orchid Digest, and other periodicals. I aslo compiled a CATALOG OF CYMBIDIUM SPECIES.

Two of my favorite endeavors in Cymbidium hybridizing, have been the raising of many miniature-bowered and early-flowering types. By means of treating Cymbidium backbulbs with colchicine, I produced, to the best of my knowledge, the first flowered tetraploid orchid that originally had been a diploid.

In 1971, as the result of injuries sustained by both of us in an automobile accident, my husband did not survive. This was a severe loss. Only the sympathy and advice of relatives and friends, such as that of W. Quinn Buck and Charles Hardman in the Amaryllis field, and Lambert Day and Ernest Hetherington in the orchid field, was I able to continue my horticultural pursuits. For, despite the passing of the years, and regardless of some ill health, my interest in horticulture is as enthusiastic as ever.

IN MEMORIAM - WILLIAM QUINN BUCK, 1908-1976

I.

The members of The Southern California Hemerocallis and Amaryllis Society, and The American Plant Life Society, were shocked to hear of the sudden death of William Quinn Buck on February 29, 1976. Frederick C. Boutin visited with him on the evening of February 28, when they collected pollens which they planned to use in plant breeding later. That night he passed away peacefully in his sleep. He had been busy with his horticultural activities to the very last. He had sent in his 1974-1975 Daylily Reports, as Chairman of the Daylily Committee, for publication in the 1976 PLANT LIFE, and these were his last contributions to horticultural literature.

Mr. Buck was among the three pioneers in breeding tetraploid daylilies as is shown in the literature (1, 2, 3, 4, 5, 6, 7, 8, 9). His contributions extended to elaborate methods for polyploidizing (2). He devoted most of his time since the 1950's to the breeding of tetraploid daylilies, and leaves a large collection which he has willed to The American Plant Life Society along with most of his estate as shown by the following Last Will and Testament:

LAST WILL AND TESTAMENT

OF

W. QUINN BUCK, also known as WILLIAM QUINN BUCK

I, W. QUINN BUCK, also known as WILLIAM QUINN BUCK, a resi-

dent of the City of Arcadia, County of Los Angeles, State of California, do hereby make this, my Last Will and Testament.

FIRST: I revoke all Wills and Codicils to Wills heretofore made by me.

SECOND: I declare that I am unmarried; and, that I have no children either living or deceased.

THIRD: I give and bequeath to MARY SHREVE of Atascadero, California, all of my personal effects, furniture, furnishings, paintings, books and jewelry.

FOURTH: All of the rest, residue and remainder of my estate, I give, devise and bequeath to the AMERICAN PLANT LIFE SOCIETY, P. O. Box 150, LaJolla, California 92037.

FIFTH: I nominate and appoint MARY SHREVE as Executrix of this, my Will, to serve without bond. In the event that she is unable to act, I nominate and appoint LANETTE HURDLE of Norco, California, as her alternate and successor, likewise without bond. I authorize my Executrix, or her alternate, to lease, encumber and sell the property of my estate, subject to such confirmation of law as may be required.

IN WITNESS WHEREOF, I have hereunto set my hand this 24th day of April, 1974.

W. QUINN, BUCK, also known as WILLIAM QUINN BUCK

The foregoing instrument, consisting of two (2) typewritten pages, including this page, was at the date thereof by the said W. QUINN BUCK, also known as WILLIAM QUINN BUCK, subscribed at the end thereof and published as, and declared to be, his Last Will and Testament, in the presence of us, who, at his request and in his presence, and in the presence of each other, have subscribed our names as witnesses thereto.

Dexter D. Jones, residing at 675 Hampton Rd., Arcadia, Calif.

Helen L. Gains, residing at 516 Santa Cruz Rd., Arcadia, Calif.

The Buck tetraploid daylily collection will be carefully evaluated under the expert hand of Frederick C. Boutin, Botanist, Huntington Botanical Gardens, San Marino, Calif. The very best hybrid seedling will be named in honor of Mr. Buck, and the germ plasm of the collection will be available for daylily breeders who are members of the Southern California Hemerocallis and Amaryllis Society and The American Plant Life Society. Other fine seedlings will be tested, named and released.

In recognition of Mr. Buck's outstanding contribution to the breeding of daylilies and other amaryllids, The American Plant Life Society awarded him the prestigious WILLIAM HERBERT MEDAL in 1969. The 1969 issue of PLANT LIFE was dedicated to him; and to which he contributed a charming autobiography with portrait (3), and his annual Daylily Report (4).

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Mr. Buck devoted his life to the breeding of plants, particularly daylilies. His charming personality and unselfish devotion to horticulture, and his outstanding tetraploid daylilies, will stand as a fitting monument to his memory.—**Hamilton P. Traub**

II.

The sudden death of Quinn Buck, a longtime and esteemed friend of my husband and myself, was sad indeed. From the time in the forties when he was a technician in the Floriculture Department of UCLA, through the years at The Los Angeles State and County Arboretum and later during his work with his beloved daylilies, he was a source of inspiration and advice to us.

His interests and ours crossed in various pursuits: in growing Nerines and other Amaryllids, in growing Orchids, especially Cymbidiums and in the culture of flowering trees, including the gorgeous Chorisias. In his methods of doubling the chromosome numbers of various plants by the use of the alkaloid colchicine, Quinn had adapted an ingenious method of treating daylilies that enhanced both the substance and the size of the flower.

What better memorial for him than the flowers he loved and improved—his legacy to us!—*Emma D. Menninger*

III.

Quinn Buck and I first became acquainted some 13 years ago when we were both employed by the Los Angeles County Department of Arboreta and Botanic Gardens. At the time I was aware of Quinn's intense interest in the Amaryllidaceae and the breeding work he was doing with *Amaryllis, Cyrtanthus,* and *Hemerocallis,* but it was 10 years before I began working with the members of this family. For the last three years our mutual interest in *Amaryllis* brought us together many times to plan crosses and exchange plants and seed. The evening before he passed away we spent in his greenhouse collecting pollen and making crosses and anticipating future crosses. Many of his hybrid amaryllis will be in display plantings in the Huntington Botanical Gardens and will be used for breeding future generations of hybrids.—*Frederick C. Boutin*

1976 HERBERT MEDAL PRESENTATION

At a ceremony in the Mayor's Parlour at Roodepoort Town Hall, Transvaal, on Thursday evening, February 5, 1976, the Mayor, Clr. W. J. de Vos, read the citation in connection with the award of the 1976

WILLIAM HERBERT MEDAL to Mr. Floor Barnhoorn, of Little Falls, Transvaal, South Africa, in recognition of his outstanding work in breeding Hybrid *Amaryllis* for the world wide commercial trade. The Medal presentation scene is shown in Fig. 2.

Fig. 2. The 1976 **William Herbert Medal** presentation scene, Mayor's Parlour, Roodepoort, Transvaal, Thursday evening, February 5, 1976. Mr. Floor Barnhoorn, **left**, addresses the gathering while the Mayor, Clr. W. J. de Vos, **right**, who presented the Medal, and others present, listen. Photo **West Rand Times en Wesrander**

THE EDITOR'S MAIL BAG

On January 28, 1976, we enjoyed a visit with Frederick C. Boutin, Botanist, from Huntington Botanical Gardens, San Marino, Calif.

The editor enjoyed a visit on February 3, 1976, with T. D. Jacobson, Botany Department, Washington State University, Pullman, Wash.

We are saddened to record the death of Dr. Philip G. Corliss of Somerton, Arizona and San Diego, Calif., on April 11, 1976.

At its June 2, 1976 New Orleans meeting, the Botanical Society of America, awarded to Dr. Thomas W. Whitaker its Certificate of Merit in recognition of his distinguished achievements and contributions to the advancement of Botanical science, particularly his contributions to

the understanding of economic plants, notably their improvement, and for a unique contribution in expressing this understanding in terms of their domestication and their influence on the development of civilization.

LINNAEUS BICENTENNIAL IN 1978. Dr. Armando Mencia, Hotel Tamanaco, Apartado de Correos 467, Caracas, Venezuela, wrote to Mrs. A. C. Pickard, Alvin, Texas, about naming an outstanding hybrid Amaryllis clone in honor of Linnaeus on the occasion of the Bicentennial of Linnaeus' death in 1978.

Under date of May 27, 1976 he wrote to Mrs. Pickard as follows: "Some years ago, I visited Uppsala, Sweden, to pray at Linnaeus' grave in the subperb Uppsala Cathedral. I also went to his home at Hammerby, a fascinating place, now used as a museum. I have the greatest admiration for Linnaeus, and feel that the tribute of having an Amaryllis clone, preferably a double one, named for him on the occasion of the Bicentennial of his death in 1978 would be a well-deserved honor to this great botanist. Since this event is two years in the future, there will be ample time to select a suitable Amaryllis hybrid to bear his name."

Amaryllis breeders are requested to bear this in mind and if possible name an outstanding Amaryllis Hybrid in memory of Linnaeus in 1978. Dr. Mencia states that he will be delighted to hear from the American Amaryllis Society members regarding his suggestion, and other matters concerning Amaryllis .

1. REGIONAL ACTIVITY AND EXHIBITIONS

THE 1976 AMARYLLIS SHOW SEASON

The 1976 Amaryllis Show Season began on April 3 with the *New Orleans Intra-Club Amaryllis Show,* and was followed on April 10-11 with the *Greater Houston Amaryllis Show.* Two shows were staged on April 10-11, the *Corpus Christi, Texas, Amaryllis Show,* and the *Greater New Orleans All-Horticulture Amaryllis Show.* The *Houston Amaryllis Show* was held on April 11. The *Southern California Hemerocallis and Amaryllis Show* and *The Amaryllis Society of Alabama Show,* were staged on April 24-25. The show Season closed with the *Spring Extravaganza* at the California Arboretum Foundation and the Los Angeles State County Arboretum at Arcadia, California on May 22-23.

NOTE TO AMARYLLIS SHOW ORGANIZERS

It is important to designate some one to write a *brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub,

Editor, Amaryllis Year Book, 2678 Prestwick Court, La Jolla, Calif. 92037. *Your plans are not complete until this appointment has been made.* Only in this way is a permanent international record of your show assured.

1976 NEW ORLEANS INTRA-CLUB AMARYLLIS SHOW

L. W. Mazzeno, Jr.,
944 Beverly Gardens Drive, Metairie, La. 70002

On April 3, 1976 The Men's Amaryllis Club of New Orleans held its fourth annual Intra-Club all horticulture Amaryllis Show at the City Park Backer Room. Each year the interest shown by Club members in this Show increases. From the greatest number of entries thus far, trophies were awarded as follows: (1) best 4-floret specimen, a 'Summertime' displayed by George Merz, Jr.: (2) best 3-floret specimen, a *red seedling* by Holly H. Bowers, Jr.: (3) best 2-floret specimen, 'White Christmas' by Albert Touzet.

The Club's regular annual Show, open to the public, was held on April 10-11 and is reported separately.

GREATER HOUSTON AMARYLLIS CLUB SHOW, 1976

Mrs. Sally Fox, *Corresponding Secretary,*
1527 Castle Court, Houston, Texas 77006

The Greater Houston Amaryllis Club opened the Garden Center, in Houston, Texas to the public to view its Amaryllis show on April 4th, 1976.

A six foot cardboard replica of the Liberty Bell covered with red and white Amaryllis was the Club's tribute to the birthday of our Country, and carried out the theme "Amaryllis Bicentennial Celebration". There were eight amaryllis floral arrangements in keeping with the theme which made our show very attractive to the visitors.

Judging was done by Accredited Amaryllis Judges, whose selections were:

'Golden Triumphator' shown by Mrs. G. D. Everett, who received an Award of Merit. She was presented the Club's tray for this specimen.

'Picotee' with two four-bloom scapes was the outstanding entry of Mrs. Edwin Marek. She earned an Award of Merit and the Ludwig Challenge Cup.

Mrs. G. D. Everett also won a silver plate for an 'American Hybrid', along with an Award of Merit. This was the second consecutive win, so the trophy is hers permanently.

Mrs. W. J. Snow entered a perfect 'Senorita' in the Specie Division, and was presented a silver plate.

Another repeat winner, whose silver trophy is now hers, was Mrs. Robert M. Rucker, Jr. for the best 'Dutch Seedling' entered. The coloration was very different from most red shades since it shaded from deep

orange into light red. This was a real beauty, with two scapes in bloom. She is also again the proud possessor of the Preliminary Commendation Award from the American Amaryllis Society.

'Sweepstake' award of the Warnasch tray went to Mrs. P. A. Froebel for most blue ribbons in the show.

Other sections had too few specimens for competition so no other trophies were given out.

Again the "Educational Exhibit" prepared by Mrs. A. O. Aschenbeck was a focal point as many visitors were especially interested in methods of propagation, which the Hostesses discussed freely.

Our "Dutch Seedling" section boasted more specimens than any of our previous shows and the number of high scores indicated it was difficult for the Judges to make their selection for the Preliminary Commendation Awards. We are gratified that some of our members are being so successful in their hybridizing programs.

The weather conditions in the Gulf Coast area are always a challenge to those of us who grow our Amaryllis in open beds, and it was a relief to have an abundance of specimens this year for our show. Even our "Invitational" section had seven entries and the top score went to Mr. Ray Stevens for a near perfect scape of 'White Witch'. This silver plate becomes a permanent possession for the winner of this section each year.

As a result of our show we added three new members to our roster, which helped fulfill our goal of promoting interest in growing Amaryllis.

Mrs. A. O. Aschenbeck and Mrs. Sally Fox served as Chairmen of the show.

CORPUS CHRISTI (TEXAS) AMARYLLIS SHOW, 1976

MRS. CARL C. HENNY, *Corresponding Secretary, Coastal Bend Amaryllis Society, P. O. Box 3054, Corpus Christi, Texas 78404*

Our Coastal Bend Amaryllis Society members were quite pleased to have had 48 entries within our Amaryllis exhibit, despite a very warm winter and very little rain during the winter months. The "Festival of Flowers" of Corpus Christi, Texas, was held on April 10th and 11th in the City Coliseum in which we participated. The Theme for the show was "HAPPY BIRTHDAY, U. S. A." commemorating our National 200th Anniversary. A very large Birthday Cake, illuminated with 200 electric candles, was displayed at the entrance of the Show.

Ludwig named and registered Amaryllis entered were: 'Bouquet', 'Apple Blossom', 'Carina', 'Gipsy Giant', 'Fire Fly', 'Picotee', 'Franklin Roosevelt', 'Royal Dutch', 'Voodoo', and 'White Favorite'. Many of the named varieties had bloomed early or were late bloomers for the show. Mrs. Carl Henny was fortunate to have *Sprekelia formosissima* to enter as a specimen.

Mr. Duane Eckles was awarded the "SILVER BOWL" given club

members for receiving the greatest number of blue ribbons received in the Ludwig Registered and Named Amaryllis. His entries were 'Royal Dutch', 'Franklin Roosevelt', 'Voodoo', 'Gracilia', and 'White Favorite.' He received an Award of Merit, given by the American Amaryllis Society for his entry of 'Voodoo' which scored 96 points.

A *"SPECIAL TROPHY"* was awarded to *Mr. J. M. Mabe*, non-club member, for his entry of 'Gipsy Giant' which scored 93 points.

Fig. 3. New Orleans 1976 All-Horticulture Amaryllis Show—some Show winners, **standing, from left to right,** Vincent J. Peuler, winner of "Best in Show Award," and A. T. Diermayer, Co-Chairman and winner "Best Double Specimen" award; **seated,** L. W. Mazzeno, Jr., winner of Mahan Trophy for best named and registered specimen.

Mrs. Carl C. Henny, club member, received a "SPECIAL TROPHY" for receiving the greatest number of blue ribbons in the "BREEDERS CLASS".

Miss Winnie Joiner, club member, received an "AWARD OF MERIT", given by THE CORPUS CHRISTI COUNCIL OF GARDEN CLUBS for her entry of 'Apple Blossom' which scored 96 points.

Mrs. Elsie Balke, club member, and *Miss Winnie Joiner* both

received "Awards of Merit" from the American Plant Life Society and American Amaryllis Society, for their entries of Bouquet (score 95 points) and 'Apple Blossom' (score 96 points).

PRELIMINARY COMMENDATION AWARDS; given by the American Amaryllis Society, were awarded to *Mrs. Sheriton Burr* for her unnamed hybrids—scoring 95 and 96 points, and to *Mrs. Earl Jones*, non-member, and *Miss Gladys Sandefer*, non-member, for their garden grown unnamed hybrids, which scored 95 points.

Our Coastal Bend Amaryllis Society also constructed a Sales Booth in the concourse of the Coliseum, illustrated with posters displaying the colorful *Amaryllis* blossoms, and instructions in regard to their culture. Potted *Amaryllis*, in bloom, were potted previously by club members, and then displayed and sold to the public. This added feature helped to publicize the beauty of the *Amaryllis*.

Judges for our Amaryllis Exhibit were Mrs. G. Browning Smith, of Harlingen, Texas; Mrs. M. F. Locke, of Kingsville, Texas, and Mrs. D. L. W. Carter, of Corpus Christi, Texas.

1976 GREATER NEW ORLEANS OFFICIAL ALL-HORTICULTURE AMARYLLIS SHOW

L. W. Mazzeno, Jr.
944 Beverly Gardens Drive, Metairie, Louisiana 70002

For its seventeenth annual all-horticulture Amaryllis Show, the Men's Amaryllis Club of New Orleans chose the beautifully appointed mall of the Lake Forest Plaza in New Orleans, La. The Show was held on April 10-11, 1976, and again the public was invited to participate in and view this spectacular display of Amaryllis at their peak of bloom. Total entries were 364, with 62 coming from non-members. The latter accounted for 16 blue ribbons and one trophy.

For the first time in the history of this Show an F_1 species hybrid won the award for the "Best-in-the-Show." with this bloom Vincent Peuler also won the Amaryllis, Incorporated award for best species specimen. Mr. Peuler's hybridizing ability was further displayed in his capturing the coveted Robert Diermayer memorial award for the best breeder's hybrid. For the second consecutive year Holly H. Bowers, Jr. won the greatest number of trophies and awards in the Show: the T.A.C. Construction Co. Award for best unnamed, unregistered hybrid, the Reuter Seed Company, Inc. Award for best cut flower with an 'Orion,' the George Merz, Jr. President's Trophy for most blue ribbons (22) won by a Club member, the Amaryllis Society of Baton Rouge Inc. Trophy for the best unnamed single floret specimen, the O. J. Robert, Sr. Trophy for best potted three-floret registered hybrid 'Fantastica,' the Nola Luckett Trophy for best two-floret potted specimen, the Laurence Mazzeno Trophy for best miniature hybrid 'Firefly,' and two Sweepstakes Rosettes. The James Mahan Memorial Award for best registered and named hybrid was won by L. W. Mazzeno, Jr., with a

beautiful 'Hellas.' George Merz, Jr. took the W. J. Perrin Memorial Award for runner-up in this category with an 'Orion.' His 'Apple Blossom,' a perennial favorite and champion bloom, took the Ludwig Challenge Cup for best registered Ludwig hybrid. Co-Chairman of the Show, Mr. A. T. Diermayer, added to his collection of silver with the Lester Laine Trophy for best potted specimen double flower and the Edward F. Authement Memorial Award for runner-up to the T.A.C. Award. The Vincent Peuler Award for the best registered single floret went to L. W. Mazzeno, Sr's 'Glorious Victory'. Harold Reinhardt won the Member's Choice Rosette for another striking 'Apple Blossom.' Rounding out the trophy winners was Cathy Gautier, a non-member, who captured the Southern Seed and Popcorn Co. Inc. Trophy for runner-up in the breeder's class.

Other Club members meriting blue ribbons were T. A. Calamari, Jr., Emile Flauss, Al Touzet, Jerome Peuler, O. J. Robert, Sr., Vincent Pannell, and Lester Laine.

It would be impossible to list all the individuals who helped make this Show the success that it was. Some must be singled out, however, for special attention: Emile Flauss, Chairman, for his attention to the myriad of details involved; A. T. Diermayer, always the "work-horse," the Co-Chairman and Publicity Chairman. Mr. Diermayer's efforts resulted in articles and announcements in all the major gardening magazines, radio and TV coverage including personal appearances by Club members on one show aired through 13 Southern States. Special thanks go to all participants in the Show and special appreciation to our judges, donors of the trophies and other awards and to the members of the Amaryllis Society of Baton Rouge for their assistance.

1976 HOUSTON AMARYLLIS SOCIETY SHOW

Mrs. A. C. Pickard, *Official Show Chairman,*
1909 Alta Vista, Alvin, Texas 77511

"Amarysso" was the theme of the Houston Amaryllis Society's Bicentennial Flower Show on April 11, 1976. Mrs. L. E. Morgan, President and Show Chairman along with Mrs. R. L. Culpepper, Staging Chairman arranged a very beautiful show which aroused great public interest. A fine job was done by Mrs. Troy Wright, Awards Chairman and Mrs. Leo Hellman, Plant Sales Chairman.

Awards were given by Nationally Accredited Amaryllis judges to the following: Mrs. L. E. Morgan, receiving awards for Ludwig's 'Maria Goretti,' "Queen of the Show" and the Award of Merit for 'Apple Blossom', Mrs. J. W. Isaacs for Flora Queen in possession less than one year, Mrs. E. E. Koon receiving the high award in the Gracilis Division, Mr. Duncan Thomas was awarded highest score in the Breeders Class for a beautiful Leopoldi type seedling and Mrs. L. E. Morgan won the Sweepstakes Award for her fine efforts. The Invitational Class (not in competition with society members) exhibits were beautiful Dutch named hybrids. The winner in this division was Mrs. Francis Peltier.

Potted plants and cut specimens with two florets per scape with no evidence of another were exhibited as display. These exhibits received special awards that do not count as points toward a higher ribbon or prize award (so states A. A. S. Horticultural rules). The class for non registered named clones (unclassified) received regular ribbon awards and cannot be counted as points toward prize awards.

The excellent Educational exhibit was presented by Mr. and Mrs. E. E. Koon. As usual this exhibit was the center of interest, with information and displays on the Amaryllis Family, showing the different stages of growth from seeds to blooming plants.

The Theme of the show and historic background was presented in the Artistic Section using Amaryllis blooms in each class. Mrs. E. H. Blankenship was Chairman. The various classes were—Class I "Sweet Land of Liberty", Red, White and Blue; Class II "Glorious Freedom" using all fresh plant material; Class III "This is my own Native Land" with fresh and dried materials.

A great deal of thanks are due to Mrs. A. A. Brittain, Publicity Chairman. Her editorials in news papers, major magazines, radio and television coverage of the show prompted Amaryllis lovers, nuserymen, commercial growers and landscape architects never to forget the fact that the *Amaryllis* is the most versatile and beautiful spring flowering bulb to grow in the garden or pot culture.

SOUTHERN CALIFORNIA HEMEROCALLIS AND AMARYLLIS SOCIETY SHOW, 1976

C. D. Cothran, *1733 North Gibbs St., Pomona, CA. 91767*

The twelfth annual show was presented this year by the Society on Saturday, April 24, and Sunday April 25 with the very appropriate theme "Beauty on Parade". As usual the show was staged in the Lecture Hall of the Los Angeles County and State Arboretum at Arcadia, with Mrs. Forrest Rosen as the chairman.

There were eleven exhibitors taking part in the show, with more than one hundred entries in the various classes. In addition we had several hundred field grown blooms from Mr. E. A. Angell of Loma Linda, and Mr. Bruce Claflin of Upland. The weather had been excellent for some time, and all blooms had developed extra size, color, and quality. The flowers had the sparkle which enchanted the visitors, and brought exclamations of delight as they entered the Lecture Hall from above.

The Cecil Houdyshell sweepstakes trophy was won by C. D. Cothran of Pomona, but this year there was no Ludwig Challenge Cup winner. In the hybridizer section C. D. Cothran beat out Henry Myers to win the best Leopoldii seedling (see Fig. 4.) and the same one was judged the best overall seedling. Furthermore, our visitors placed it first in the popularity poll. (It is to be registered and called 'Favorite')

The best Belladonna in the hybridizers section was a beautiful small pink developed by Mr. Sterling Harshbarger. The Reginae class was won by C. D. Cothran with a lovely red derived from the Angell strain.

The best flower in the show, Judges Award, went to 'Cupido' which was exhibited by C. D. Cothran. This bloomed at exactly the right moment to be crisp, wide open, and sparkling.

Fig. 4. Southern California Hemerocallis and Amaryllis Society Show, 1976. **Upper, In Memoriam** to the late Quinn Buck, designed and placed by Mrs. Barbara Gardner; note **HERBERT MEDAL** (center); **lower,** C. D. and Mildred Cothran, with "Cupido" with Judges' Award. Photo by Phil Rosoff

Preliminary commendations were given to Henry Myers for a large white and apricot blend Leopoldii type seedling which, not surprisingly, was runner up for the most popular flower in the show, and also to Henry Myers for a very lovely pink; to C. D. Cothran for a large white

Fig. 5. Southern California Hemerocallis and Amaryllis Society 1976 Show. **Upper,** Best seedling Leopoldii type **(tall flower scape, upper right hand of picture)**, given Overall Judges' Award, and popularity Poll Winner, placed by C. D. Cothran. **Lower,** Dr. Thomas W. Whitaker, Secretary of the American Plant Life Society, and Mrs. Gladys Williams, senior Judge. Photos by Phil Rosoff

with orange spots, and a dark ring in the throat, and for a large white with red freckles. All four of these flowers were very fine, and were much appreciated by the show visitors.

Ribbon rosettes were given both to Mr. Angell and to Mr. Clafflin for their background flowers with the beautiful colors, size, and sparkle. A ribbon was also given to Mrs. Robert Melton for her lovely flower arrangements, and to Henry Myers for a fine specimen of *Clivia* in full bloom.

Methods of germinating seed were shown in a display by Fred Boutin, and since packets of seed were given to all visitors who wanted them, the display attracted much attention. Addresses of bulb suppliers were also available. A very large number of people visit the Arboretum on Saturday and Sunday, and most of them visited the show. Their genuine interest was shown by the fact that quite a large number asked to join the Society. The popularity poll again proved its worth by making the visitors look at each entry very carefully. There were numerous low voiced debates over this flower, or that one, and many visitors felt they had to tell a host why they voted the way they did.

Mrs. Gladys Williams was senior judge, and judges Roger Fesmire. Joseph Werling, and Jack McCaskill assisted.

THE AMARYLLIS SOCIETY OF ALABAMA INC. SHOW—1976

MRS. VELMA THOMPSON, *President,*
Box 17, Mt. Vernon, Ala. 36560

The Amaryllis Society of Alabama Inc., held its Eighth Annual Spring Show at the Civic Center on Grant Street in Chickasaw, Alabama on April 24th and 25th, 1976. The theme of the show was "Rainbow of Amaryllis." There was much interest shown in both the horticulture and artistic arrangement divisions. Mr. Fred Fambrough of Eight Mile was the Show Chairman this year.

Mrs. Velma Thompson, Mt. Vernon, Alabama, won the American National Bank Trophy, for best named Dutch Potted Specimen. In addition, Mrs. Thompson won the following trophies: Claude H. Moore Memorial Trophy: for most outstanding horticultural specimen, potted Dutch Amaryllis. Division III. Silver Tray. Wilmer Smith Trophy: for most outstanding potted bulb specimen in show. Silver Pitcher.

Mr. Dewey Hardy, Eight Mile, received the Cecil Bates Trophy. Educational Display.

Mr. C. E. Tagert, Mobile, the following trophies: Chavis Furniture Comany Trophy: winner, most blue ribbons, Divisions I-VIII. Large Silver Tray with handles. Mr. & Mrs. H. P. Wheat Memorial Trophy: winner, most blue ribbons in potted and cut seedling divisions, VII and VIII. Large Silver Tray with handles. Emile Scheurmann, Sr. Memorial Trophy: winner, most blue ribbons; combined horticulture and artistic arrangement divisions. Silver Champagne Cooler. Amaryllis Society, Ala., Inc., Trophy: winner, most blue ribbons in cut Dutch

Division, Division IV. Silver Tray. First National Bank, Mobile Trophy: best specimen, Division VII. Silver Paul Revere Bowl. Merchants National Bank Trophy: most blue ribbons, horticulture Divisions I-VII. Silver Tray. T. J. Swetman Trophy: most blue ribbons, Division III. Large Ceramic Tray. Vincent Kilborn Sr. Memorial Trophy: most blue ribbons, Division IV. Silver Bowl. Mae Brown Trophy: most outstanding potted bulb specimen, named American Amaryllis. Crystal Bowl. C. E. Tagert, Sr. Trophy: most blue ribbons, single bloom unnamed division . Small Silver Bowl. C. E. Tagert, Sr. Trophy: most blue ribbons, single bloom division-novelties. Small Silver Bowl. C. E. Tagert, Sr. Trophy: most blue ribbons, single Bloom named division. Small Silver Bowl. Claudine Pierce Trophy: most outstanding collection, three scapes, Division X. Book Ends.

Mr. Fred Fambrough, Eight Mile, won Central Bank of Mobile Trophy: most blue ribbons, American potted Amaryllis, Division I. Silver Tray.

Mrs. Claudine Pierce, Mt. Vernon: Little Glass Shack Award: most outstanding cut miniature Dutch Amaryllis. Crystal Vase.

Mrs. Irene Massingill, Chickasaw won: Sully's Drive-In Trophy: winner, most blue ribbons artistic arrangement division. Silver Bread Tray. Mittie Young Trophy: most artistic design, amaryllis, elements other than fresh plant material predominating. Silver Award. Velma Thompson Trophy: most outstanding artistic arrangement in show. Relish Dish. West Department Store Award (Chickasaw): most blue ribbons, artistic arrangements Division XI. Ladies Timex Watch.

Mrs. M. W. Lauderbough, Chickasaw: Inez L. Palmer Trophy: garden club winner, Division X, Section 43. Silver Compote

The Judges for the show were from Hattiesburg, Mississippi and Pensacola, Florida. The Hattiesburg Judges were: Mrs. E. R. Trussel, Mrs. Mollie Fowler, Mrs. Luther N. Davis, Mr. Luther N. Davis. The Pensacola Judges were: Mrs. J. T. Barfield, Mrs. J. E. Haynes.

After the judging of the show, the Judges were guests of The Amaryllis Society of Alabama, Inc., at a luncheon at a Mobile Restaurant.

1976 SPRING EXTRAVAGANZA

C. D. Cothran, *1733 North Gibbs St., Pomona, Calif. 91767*

The California Arboretum Foundation and the Los Angeles State and County Arboretum at Arcadia, California presented their "Spring Extravaganza" on May 22 and 23 of this year, and the Southern California Hemerocallis and Amaryllis Society was again invited to put in a display in the Lecture Hall. C. D. Cothran was chairman, and was assisted by Bob Melton, Gladys Williams, Sterling Harshbarger, Gertrude Rosen, Fred Boutin, and Joe Werling. About forty scapes of *Amaryllis*, several potted *Hemerocallis*, and several trays of cut *Hemerocallis* were tastefully arranged on four large tables. The Dutch clones

'Dutch Doll', 'Wedding Bells', 'Apple Blossom', and 'Eastern Dream' were among the *Amaryllis* blossoms, most of the remainder being Cothran seedlings.

Catalogs, Ludwig's color catalog, seedling growing instructions, and tiny seedlings in a growing planter were displayed. Packets of seed were available to all who wanted them, and at least two Society hosts or hostesses were present the entire time during the two days. Hundreds of people took seed, asked questions, and a number asked to become members of the Society.

It was estimated that more than twenty thousand visited the Arboretum during the two days, and apparently about half of them stopped at our exhibit to look and ask questions. It certainly is a fine way to make the gardening public aware of high quality *Amaryllis* and *Hemerocallis.*

PROPOSED CHANGE IN POINT SCALE FOR JUDGING AMARYLLIS SHOWS

Submitted by MRS. A. C. PICKARD, *Amaryllis Judging Instructor, 1909 Alta Vista, Alvin, Texas 77511*

I would like to express my viewpoint on the proposed change in point scale for judging Amaryllis which appeared in the 1976 Plant Life.

The judging of Amaryllis is governed, or should be, by rules formulated by the American Amaryllis Society. It has been the experience of Judging Instructors, Judges, and authorities on any subject to find that experts do not necessarily agree. However, we would fail to meet our goal of perfection in judging if we did not voice our views, however different they may be, and constructive criticism.

Breeders and hybridizers are constantly producing new varieties, increasing the color range and improving disease resistant types. Here again it becomes necessary to assure that no important points are overlooked to facilitate equitable standard judging. I agree with some of the other judges regarding the present method. Rating points for color are rather high; giving more points to perfection of flower shape would be in order.

Form may be defined as to the shape, symmetry and depth of bloom. Each floret should be symmetrical due to balance or harmony of all parts of the bloom.

Symmetry means beauty due to balance of harmony or parts and may be broken down into two categories: (1) trueness to type (2) development, which covers overmaturity. These blooms are known to change form as the bloom continues to mature. Maturity is to be considered the ideal symmetrical form.

Flower forms of Amaryllis blooms range from long trumpet-like Easter Lily form to hugh open-faced Dutch hybrids, from the irregular orchid shapes to double forms. Rating is strictly within the Division Standard on the basis of beauty of form. The six tepal segs in each

blossom make up the characteristic form of the bloom. The lower center pet seg is smaller than the other two inner pet segs and are very often inclined to a slight turn. The tepal segs tips should be uniformly pointed or rounded and all reflexing approximately the same degree. While not circular, the Amaryllis blossom should be symmetrical with the same size segs approximately the same distance apart on each side of the bloom. Any twisting of any segs or the whole bloom should require point deduction. The National Council of State Garden Clubs, Inc. in their "Handbook for Flower Shows", defines form as "a well-proportioned, symmetrical, and graceful shape of a flower or inflorescence. Also the shape or habit of growth of a plant".

The suggestion of Mr. Mazzeno, Jr., in the 1976 *PLANT LIFE*, page 38, is a timely one. As shown in my article in 1971 *PLANT LIFE*, page 26, the points for *floret shape* (15), are a little low; those for floret color (45), and length and character of scape (15), rather high. I would suggest the compromise solution as shown in the following table:

PROPOSED SCALE OF POINTS

		POTTED PLANTS	
	Single specimen	Single scape	2 or more scapes
Perfection of floret *shape*	20	20	15
Conformity to floret *color* standard	30	30	25
Flower *size*	15	15	15
Pose (symmetry of florets in umbel)	10	10	10
Length and character of scape (stalk)	5	5	5
Number of scapes per plant			10
Number of florets per scape	6	6	6
Fragrance	2	2	2
Foliage		2	2
Condition of exhibit	12	10	10
	100	100	100

AMARYLLIS JUDGING—ACTION OF EXECUTIVE COMMITTEE, JAN. 4, 1977

Mr. L. W. Mazzeno, Jr., is to be congratulated for his timely suggestion for a change in the scale of points for judging Amaryllis exhibits at the official shows. Mrs. A. C. Pickard is to be commended for suggesting a workable compromise which gives due weight to Mr. Mazzeno's suggestion, and it is approved by the Executive Committee.

If after a period of years, any further adjustments should appear to be needed, then the judges should suggest further changes.—*Hamilton P. Traub, Secretary, Executive Committee*

Mrs. E. H. Blankenship, 811 LeGreen, Houston, Texas 77008, writes under date of January 19, 1977:

Congratulations! The American Amaryllis Society's new scale of points for judging Amaryllis (approved by the Executive Committee Jan. 4, 1977) is just the very one we needed.

Our leader, Mrs. A. C. Pickard, sent our Houston Amaryllis Society members a copy of the scale and I am very happy. The new scale of points will provide a better way to handle the overall judging. We appreciate having this excellent guide.

Mrs. H. Ward Blair, President, The Houston Amaryllis Judges Council, writes under date of Feb. 2, 1977:

The Houston Amaryllis Judges Council wholeheartedly endorses the change in the point scale for judging Amaryllis Shows.

LOCAL NEWS LETTERS

The Mens' Amaryllis Club of New Orleans, Inc., NEWS LETTER, Vol. 19. No. 6. February 1977 has been received. It is a mine of valuable information on Amaryllis culture and breeding.

The Southern California Hemerocallis and Amaryllis Society, NEWS LETTER for January 1977 has been received. It contains a report on the January meeting at the Los Angeles State and County Arboretum, Arcadia, Calif. The dates for the annual Amaryllis Show are April 22, 23, and 24, 1977.

PLANT LIFE LIBRARY—continued from page 127.

GARDENING WITH PERENNIALS, MONTH BY MONTH, by Joseph Hudak. Quadrangle/New York Times Book Co., 10 E. 53rd St., New York, N. Y. 10022. 1976. Pp. xvi + 398. Iluus. $13.50. This attractive book by a landscape architect is devoted to the cataloguing the majority of the attractive and reliable hardy perennial plants, including winter hardy bulbs, for the United States and Canada, and other countries with similar climates. Most of the book (pp. 3-332) is devoted to a **Monthly Calendar,** listing the plants by months, beginning with March; including color values, brief descriptions, culture and pests. **Hardy Ferns** are listed separately (pp. 335-352). **Useful Lists,** including perennials with blooming periods of eight weeks or more; perennials with bonus foliage, with or after blooming; perennials tolerant of dry conditions; perennials with persistent winter foliage or with showy fruits (pp. 355-377). A brief bibliography; common and scientific name index completes the volume. Highly recommended.

THE COMPLETE BOOK OF GREENHOUSE GARDENING, American Edition, by Ian G. Walls. Quadrangle/New York Times Book Co., 10 E. 53rd St., New York, N. Y. 10022. 1975. Pp. x + 447. Illus. $14.95. First published in Great Britain (1973), this American Edition begins with some useful definitions about special compounds, potting mixtures; accessories and materials; methods and terms and a brief Preface to the

PLANT LIFE LIBRARY—continued on page 84.

2. LINEAGICS

[BIOEVOLUTION, DESCRIPTION, DETERMINING RELATIONSHIPS, GROUPING INTO LINEAGES]

TWO COPPER-COLORED CRINUMS

RANDELL K. BENNETT, *3820 Newhaven Road, Pasadena, California 91107*

The taxonomy of the copper-foliaged Crinums is to say the least confusing. I first became acquainted with this group while in Hawaii several years ago. Varieties with the copper foliage could be seen growing wild among the normal green types in mass groupings. These groupings were often found very close to or on the beaches in sandy soil. The large fruit of the crinum was commonly found on the beach and in the tide, demonstrating one of the natural methods by which seed of this genus is distributed. Crinums of immense size were seen growing on basal stumps. In many cases the root system would be half way out of the ground due to wind or erosion with no ill effect on the plant.

When I returned to the mainland, I was fortunate to acquire two copper-foliaged species: *Crinum amabile* forma *cuprefolium* and *C. asiaticum* forma *cuprefolium* (Traub, 1975). These were the names in use at the time. Doubt remains whether the form "*cuprefolium*" should be designated for *C. amabile* since this coloration may be the norm, not the exception. These two species are considered to be native to Asia and Polynesia but have spread in cultivation to many adjacent areas. The aquatic distribution of the fruit allows for this wide habitat. In these two species the red coloration is found in new leaves, fruit, flower stock, and flowers. The young leaves forming in the center of the rosette contain the copper pigment, turning green with maturation. The whole effect is of a two-toned plant, green on the outside and red in the center. The flower stock is a bright red throughout the flowering period, fading to green when the fruit begins to mature. The fruit seems to retain the red coloration throughout its growth. The color of the flowers undoubtedly varies according to environmental factors, especially humidity. In this area the individual flowers are white, frosted with red. The red tint is especially strong on the under side of the tepals. The tepal tube is completely red, as is the stigma, style, and filament. Anthers of *C. amabile* are a bright yellow, in contrast to the overall color scheme. It can be seen that the copper coloration is in no way limited to the foliage.

Crinum asiaticum forma *cuprefolium* Traub and *C. amabile* forma *cuprefolium* are of easy culture, provided they are protected from cultural extremes. Neither species will tolerate much frost and a relatively high humidity is desirable. They have adapted amazingly, however, to the low humidity of this section of Southern California.

I am currently growing my specimens in 20″ tubs where they make outstanding specimen plants. *Crinum asiaticum* forma *cuprefolium* Traub is characterized by a huge rosette of long, wide, accutely-pointed

leaves of a succulent nature. Commonly, over 20 leaves will be found. Unlike *C. amabile*, my specimen of *C. asiaticum* has yet to produce an offshoot, although it is attaining large size. This variety appears to be developing the horticulturally desirable trait of free blooming habit with maturity. The 30 or more flowers per umbel will probably be produced throughout the year as the plant matures. In addition, this is the first year some of the fruit is fully developing.

Crinum amabile forma *cuprefolium* is characterized by longer, thinner foliage than *C. asiaticum*. It is quick to form clumps. My specimen, estimated to be the same age as *C. asiaticum*, has ten offshoots. It has bloomed in all seasons of the year, and will undoubtedly be ever-blooming eventually. Foliage has a strong midrib and is of a succulent nature, like *C. asiaticum*. Because of its long, thin foliage (40″ or more) this species should be protected from strong winds. This is a good idea for *C. asiaticum* also. Wind can quickly destroy the appearance of a fine specimen by bending and breaking the leaves.

Both of these copper-colored varieties are highly recommended for their foliage and flowers. *Crinum asiaticum* forma *cuprefolium* Traub, in particular, is one of the most spectacular of the Amaryllids for its foliage alone. A good, rich soil mix is sufficient. Because of their natural habitat they appreciate an abundance of water when the weather is warmest and should never be allowed to become dry due to the evergreen habit. Fertilization several times a year or use of a slow-release fertilizer is recommended. Exposure would vary according to area. In hot summer localities afternoon shade or filtered light would be preferable. Mealybugs have been the only insect pest observed so far. These are easily controlled with an alcohol solution. If left untreated this pest can stunt and distort growth.

Other copper-colored Crinums have been named; most growing naturally near the two discussed here. Due to natural hybridization this group may never be straightened out taxonomically but they remain of great horticultural interest.

LITERATURE CITED

Traub, Hamilton P. *Crinum asiaticum* forma *cuprefolium* Traub, PLANT LIFE 31: 63. 1975. See Corrigenda, PLANT LIFE, Vol. 33. 1977, p. 4, change "*cuperfolium*" Traub, to "*cuprefolium*."

Syn.—Traub, Hamilton P., *Crinum asiaticum* var. *cuprefolium* Traub, PLANT LIFE 16: 93-94, fig. 25. 1960; *Crinum amabile* var. *cuprefolium* Traub, PLANT LIFE 21: 96, 1965. See Corrigenda, PLANT LIFE Vol. 33. 1977, p. 4, change "*cuperfolium*" to "*cuprefolium*".

THE GENUS **CRINUM** IN SOUTH AFRICA BY I. C. VERDOORN

L. S. Hannibal

An outstanding study concerning *The Genus Crinum in South Africa* by I. C. Verdoorn, Government Botanist for the Republic of

South Africa, Pretoria, S. A. appeared in *Bothalia,* Vol. II part 1 & 2, 1973. Historically Miss Verdoorn has been collecting, growing, identifying and researching the South African Genus *Crinum* for many years. Her report with its many excellent color plates was issued as she retired from active service. It does much to clear up the confusion concerning many species which have been described over the past two hundred years. Many of the past botanists, including Linnaeus, had little opportunity to see or compare the several score of species native to this vast area, consequently many misidentifications exist. We can only summarize her findings here.

We have two minor comments to make concerning her study: First, Miss Verdoorn relates *C. moorei* to *C. americanum* and *C. jagus* (Ex *C. giganteum*). She does not state the reason but since all three species are garden grown in Florida and the Gulf many of us know these species well. Each obviously belongs to a different archetype as seed, foliage and blossoms are quite morphologically distinct. The fault probably lies in the early descriptions and plates which lack many of the basic distinctions, or the fact that the plants may produce semifertile hybrids, but such is no indication of close affiliation.

Secondly, the report does not distinguish varients or subspecies so we have no means to determine the diversity one may encounter within a number of the species. For example, she states that *C. gouwsii* (Chromosome number 2n=72) is a synonym of *C. macowanii.* The writer has grown both, but the small stature, bulb form, environmental requirements and spicy floral fragrance of the former set it quite apart from the many larger variants of *C. macowanii.* In fact the two forms will not cross. In a like manner no mention is made of the numerous *C. bulbispermum* variants which range from *album* to *roseum* and to the deep red 'Orange River Lily' form which is a hexaploid with a count of 2n=66. The diploid (2n=22) *album* forms are far hardier than the hexaploid and the two when cross-pollinated fail to give fertile seed. We will not go into the complicated genetics involved but latent incompatabilities exist which are worth noting.

Thus in using Miss Verdoorns study one can place the normal run of *Crinum* from the wild, but when one receives a bulb from a Japanese collector presumably of Natal origin but possibly Kenya, one may have difficulties. First, it took 10 years to flower the bulb, secondly the blossoms bore some resemblance to *C. campanulatum* as to the attachment of the filaments, but the tepals were shorter and heavier. And finally the foliage was far taller and heavier that *C. campanulatum.* It is the same *Crinum* as seen along the river banks in the opening scene of the original motion picture 'Born Free' where the lion rushes the native girl. Since we have no clue to the diversity of *C. campanulatum* we do not know if the 'Born Free' *Crinum* is a subspecies or an unrecognized species.

Miss Verdoorn's synonyms for *C. kirkii* are of interest as J. D. Hooker in *Flora Indica* lists these plants as variants of *C. latifolium* or *C. l.* var. *zeylanicum.* In Zanzibar and Pemba *C. kirkii* is a salt water marsh plant with rather heavy rigid foliage since it is subject to much wind and competition from reeds. It would be difficult to grow such

a tropical species at Pretoria, let alone have normal foliage and flowers. Unfortunately no really detailed descriptions of *C. kirkii* exist so obviously some confusion exists between it and the many forms of *C. latifolium* scattered about the Indian Ocean. It is a moot question if the plant has ever been grown in Florida despite having been listed in Pliney Reasoner's Royal Palms Nursery catalogue of 1900.

Miss Verdoorn's list of described species follows.

Crinum baumii Harms.
  Syn ? *Ammocharis* baumi (Harms) Milne-Redhead & Schweick.
C. nerinoides Baker.
  Syn. ? *Ammocharis* spp. Solch.
C. bulphanoides Welw. ex Baker.
  Syn. *C. leucophyllum* Baker.
C. crassicaule Baker.
C. euchophyllum Verdoorn.
C. campanulatum Herb.
  Ex. *C. aquaticum* Burch.
C. paludosum Verdoorn.
  C. forbesii sensu van der Waldt.
C. rautanenianum Schinz.
C. carolo-schmidtii Dinter.
  Syn. *C. occiduale* Dyer.
C. moorei Hooker.
  Syn. *C. imbriaticum* Baker.
  Syn. *C. macowanii* Baker ex part Fig. only.
  Ex. *C. colenso* (Old Hort. trade name)
  Ex. *C. natelensis* (Old Hort. trade name)
C. kirkii Baker.
  Syn. *C. ornatum* (Aiton) Bury.
  Ex. *Amaryllis ornata* Aiton.
  Syn. ? *C. sanderianum* Baker ex Bury.
C. acule Baker.
C. minimon Milne-Redhead.
  Syn. *C. parvibulbosum* Dinter ex Overkott.
  Syn. *C. walteri* Overkott.
C. lineare L. f. Supp.
  Syn. *C. revolutum* (L'Heriter) Herb.
  Syn. *C. revolutum* var. *gracilor* Ker-Gawler.
  Syn. ? *C. angolense* Herb.
C. variable (Jacq.) Herb.
  Ex. *Amaryllis variable* Jacq.
  Syn. *C. crassifolium* Herb. nonen nudum.
C. foetidum Verdoorn.
C. graminicola Verdoorn.
C. delagoense Verdoorn.

Syn. ? *Amaryllis forbesi* var *Purpurea* Lindl.
Syn. ? *C. forbesianum* Herb.
Syn ? *C. forbesianum* sensu Baker.
(Note. descriptions of Forbes Crinum inadequate)

C. lugardiae N. E. Brown.
Syn. *C. polyphyllum* Baker.
Syn. *C. crispum* Phillips.

C. macowanii Baker.
Syn. *C. gouwsii* Traub (More likely a polyploid subspecies of *C. lugardiae*. L.S.H.)
Syn. *Amaryllis revolutum* sensu Jacq.
C. macowanii subsp. *confusum* Verdoorn.

C. bulbispermum (Burm.) Milne-Redhead & Sch.
Syn. *Amaryllis bulbispermum* Burm. f.
Syn. *Amaryllis longifolia* sensu Jacq.
Syn. *C. asiaticum* sensu Linn. in Mantissa Pt.
Syn. *C. longifolia* var. *riparia* Ker-Gawler.
Syn. *C. riparium* Herb.
Syn. *C. capense* Linn. = Hypoxis capensis.
Syn. ? *C. capense* Miller. (Identity questionable = *A. belladonna*?)
Syn. *C. capense* sensu Herb. = *C. b. roseum* or *album*.
Non *C. longifolium* (Linn.) Thungberg = *Cybistetes longifolia*.

Note! Plants marked "Syn. ?" indicate original descriptions and plates too vague to permit accurate determinations. The status of *C. baumii* and *C. nerinoides* requires further study as to their identification under *Crinum* or *Ammocharis*.

REGISTRATION OF NEW AMARYLLID CLONES

Mr. James M. Weinstock, *Registrar*
10331 Independence, Chatsworth, Calif. 91311

This department has been included since 1934 to provide a place for the registration of names of cultivated **Amaryllis** and other amaryllids on an international basis. The procedure is in harmony with the International Code of Botanical Nomenclature (edition publ. 1961) and the International Code of Nomenclature for Cultivated Plants (edition publ. 1958). Catalogs of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, **"Descriptive Catalog of Hemerocallis Clones, 1893-1948"** by Norton, Stuntz and Ballard was published in 1949. Additional catalogs of cultivars have been published since 1949: **Catalog of Brunsvigia Cultivars, 1837-1959,** by Hamilton P. Traub and L. S. Hannibal, PLANT LIFE 16: 36-62. 1960; Addendum. PLANT LIFE 17: 63-64. 1961; **Catalog of Hybrid Nerine Clones, 1882-1958,** by Emma D. Menninger, PLANT LIFE 16: 63-74. 1960; Addendum, PLANT LIFE 17: 61-62. 1961; **The Genus X Crinadonna,** by Hamilton P. Traub, PLANT LIFE 17: 65-74. 1961; **Catalog of Hybrid Amaryllis Cultivars, 1799-1963,** by Hamilton P. Traub, W. R. Ballard, La Forest Morton and E. Authement, PLANT LIFE. **Appendix** i-ii + 1-42. 1964. Other catalogs of cultivated amaryllids are scheduled for publication in future issues. These may be obtained at $8.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Jolla, Calif. 92038.

The registration activity of the American Plant Life Society was recognized when at the XVIth International Horticultural Congress, Brussels, 1962, the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for the cultivars of **Nerine;** and this was extended to include all the **Amaryllidaceae** cultivars, excepting **Narcissus** and **Hemerocallis,** at the XVIIth International Horticultural Congress, 1966.

Only registered named clones of **Amaryllis** and other amaryllids are eligible for awards and honors of the American Amaryllis Society at Official Amaryllis Shows.

Correspondence regarding registration of all amaryllids such as **Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis,** and so on, should be sent to Mr. Weinstock at the above address. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

REGISTRATION OF NEW AMARYLLIS CLONES, 1976

Registered by Dr. John M. Cage, 1041 Ruth Avenue, Yuba City, California 95991.

Amaryllis clone **'Careless Love'** (Cage, 1976); **A-1010;** U-4 fld; 26" h; perigone 3" long, 8½" across; intense red stripes on pure white upper ⅔, lower third white; 2 scapes in winter and recurrent; 5a type.

Amaryllis clone **'Flagred'** (Cage, 1976); **A-1011;** brilliant postoffice red (BCC), RHS 45B; perigone 3" long, 9½" across; filaments and style same intense color; florets held slightly upward; long lower petseg gives orchid impression; free blooming in winter and spring with tall scapes.

Amaryllis clone **'Jennie'** (Cage, 1976); **A-1012;** U-4 fld; 2 scapes 28" in winter; perigone 2 3/2" long and 8½" wide; color is soft orange-red (like water color on canvas) with stamens same; petaloids.

Amaryllis clone **'Pink Haze'** (Cage, 1976); **A-1013;** U-4 fld; 27" h; perigone 3" long, 8½" across; slightly recurved face; white brushed lightly with hazy pink overlay; blooms winter and sometimes mid-summer; petaloids; 5a type.

Amaryllis clone **'Royal Flush'** (Cage, 1976); **A-1014;** U-4 fld; perigone 2¾" long and 8½" wide; recurved, dark currant red brushed heavily and symmetrically on white ground; solid picotee; slightly lighter lower half; stamens same color; blooms winter and spring; 5a type.

Registered by Koninklijke Algemeene Vereeniging Voor Bloembollencultuur, (raiser G. van Staalduinen, 's Gravenzande), Onder Bescherming Van H. M. de Koningin, Parklaan 5, Postbus 175, Hillegom.

Amaryllis clone **'Helsinki'** (1976); **A-1015;** Flower is ivory white in color with the throat being somewhat yellowish green.

CORRECT NAME AND NEW SYNONYMS FOR SOME AMARYLLIDACEAE OF THE NORTHERN HEMISPHERE

Pierfelice Ravenna, *Universidad de Chile*

CRINUM LITURATUM (REICHENB.) RAV., COMB. NOV.

Amaryllis liturata Reichenbach, Icon. Desc. Pl. 1: tab 82, 1822.—*Crinum ornatum* Bury, Hexandr. Pl.: tab. 18, 1831-34 (fide Baker).—*Crinum sanderianum* Baker, Gard. Chron. n. ser. 22: 102, 187, 1884; excl. syn.: *Crinum broussonetianum* Herb. var. *pluriflorum* Herbert, Amaryll.: 260, 1837 (= *C. yuccaeflorum* Salisb.).

This charmy species inhabits Sierra Leona, in north-western Africa. It had for long been confused with *Crinum yuccaeflorum*, a

native of the same country. The latter, however, is easily separable by its nonundulated, firm textured, linear leaves.

ZEPHYRANTHES GRANDIFLORA LINDL.

Lindley, Edwards' Bot. Reg. 11: tab. 902, 1823.—*Zephyranthes carinata* Herbert, Curtis' Bot. Mag. 52: tab. 2594, 1823.—*Amaryllis concinna* Morris, Fl. Conspic.: tab. 44, 1826.—*Zephyranthes tsouii* Hu, in Hu & Woon-Young Chen. Icon. Pl. Sinic. 1: 50, 1927.

Amaryllis concinna Morris, and *Zephyranthes tsouii* Hu, are additional synonyms for the species; the latter was found in craggy places south of Yengtang Shan, in the province of Chekiang, Southeastern China. *Zephyranthes grandiflora* is a native of Mexico, Guatemala and the West Indies, but shows a clear tendency to escape from culture and establish elsewhere. Dr. F. Vervoorst (Instituto Miguel Lillo), have sent me color-slides of the species growing as a true wild on the Sierra de San Javier, Tucumán, Argentina. Dr. João Angely (*in litt.*) found it in São Paulo, Brazil. It was also gathered as an escape in Peru (see specimen cited).

Specimens: Peru, dept. Junín, Huacapistana, entre rocas cerca de la casa, 1800-1900 m; leg. R. Ferreyra 11418, 24-IX-1955 (USM).

ZEPHYRANTHES CHLOROSOLEN (HERB. EX LINDL.) DIETR.

Dietrich, Syn. Pl. 2: 1176, 1840.—*Cooperia chlorosolen* Herbert ex Lindley, Edwards' Bot. Reg. sub tab. 1835, Febr. 1, 1836; Herbert ex Hooker, Curtis' Bot. Mag. tab. 3492, Apr. 1, 1836.—*Cooperia drummondii* Herbert ex Lindley, Edwards' Bot. Reg. tab. 1835, 1836.—*Zephyranthes herbertiana* Dietrich, Syn. Pl. 2: 1176, 1840.—*Cooperia brasiliensis* Traub, Herbertia 12: 39, 1945.—*Zephyranthes brasiliensis* (Tr.) Traub, Pl. Life 7: 42, 1951.

Although the citation of the literature and author of *Cooperia chlorosolen* (the basonym) was incorrect, Dietrich's combination *Zephyranthes chlorosolen* must be accepted by implication. In fact, the article in the Botanical Magazine, which he mentions, did not include the original description but a subsequent one on the same species; moreover, it is signed by Herbert, as it is the earlier in the Botanical Register where the species was proposed.

Herbert (1837, pp. 178 and 179), says that the plant "is so variable, that three bulbs sent by Drummond separately, and perhaps from different localities, flowered at Spofforth, one with the style shorter than the tube, one longer, but shorter than the stamens, and the third longer than the stamens; the difference of stature and colour was also considerable, but the first of the tree bulbs having produced, in space of three months, five successive scapes, has itself exhibited successively all the diversities which were at first supposed to distinguish the three bulbs, and it is vain to separate them". It seems, therefore, that the binomial *Zephyranthes herbertiana* Dietr. given to the form with wine-tinged tube, is a true synonym of this species. *Cooperia chlorosolen* Herb. ex Lindl. has the priority over *Zephyranthes herbertiana* Lindley.

Cooperia brasiliensis Traub, found by Mulford B. Foster about 100 miles northeast from Curitiba (State of Paraná), apparently is a further synonym of the present species, as stated by Flory and Flag in a determination label on the type-sheet (deposited in the U.S. National Museum).

I have found *Z. chlorosolen* at the Ejido Las Yucas, NW of Aldama, in the State of Tamaulipas, Mexico. The plants, which agreed with the typical form, were growing in crevices on the apparently basaltic, rocky banks of a small river. Not far from the banks, there was a xerophile vegetation with *Beaucarnea recurvata, Ceratozamia mexicana,* or similar, Leguminosae, and others. Pressed specimens are found in the writers herbarium, the major part of it being still in Buenos Aires.

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CYTOGENETICS OF GARDEN **AMARYLLIS**

PRAKASH NARAIN,
National Botanic Gardens, Lucknow, India

I. SYSTEMATIC POSITION AND TAXONOMIC TREATMENT OF INDIAN CULTIVARS.

Amaryllis L. (Tribe *Amarylleae*) is the type genus of the family Amaryllidaceae. The genus is native of tropical and subtropical America being distributed from Mexico to West Indies, southward to Chile and Argentina. Only one species *(A. reginae)* crosses the ocean to the African continent where it grows in Princes' Island in estuary of Congo River in West Central Africa. The maximum concentration of species is in Amazon River Basin of Brazil, Bolivia and Peru, an area which may legitimately be looked upon as the centre of diversity and dispersal of the genus (4).

It is a bulbous genus with linear or lorate basal leaves and a hollow naked peduncle bearing one to two, or many flowered umbel subtended by only 2 valved spathe that separates to the base. It contains nearly 67 species and is homogenous both morphologically and cytologically (x=11). Out of these only 10 have been involved in the origin of the present day garden cultivars of *Amaryllis* (2) which are universally acclaimed for their beautiful flowers with wide range of colours ranging from orange, yellow, green, purple, pink, red and scarlet to pastel shades to pure white (4). The flowers may be large or small and long drooping trumpet shaped, large, flat and open faced or orchid shaped. They are used is gardens in beds or borders in pot culture or for interior decoration as cut flowers.

The genus has been divided into 5 subgenera by Traub (4). These are *Macropodastrum* Baker, *A. species*, Figure 6 *(5), Lais* (Salisb.) Baker, *A. vittata,* Figure 6 *(1), Amaryllis* Linn., *A. belladonna,* Figure 6 *(2)., A. stylosa,* Figure 6 *(3), Omphalissa* (Salisb.) Baker; and

Scalyana, Traub, *A. reticulata*, Figure 6 *(4)*. Similarly, the cultivated tpyes have been divided into 8 groups: Cultivated wild *Amaryllis* (D-1). Long trumpet *Amaryllis* hybrids (D-2), Belladonna type *Amaryllis* hybrids (D-3), Reginal type *Amaryllis* hybrids (D-4), Leopoldii type *Amaryllis* hybrids (D-5), Orchid flowering *Amaryllis* hybrids (D-6), Double *Amaryllis* hybrids (D-7) and Miniature *Amaryllis* hybrids (D-8).

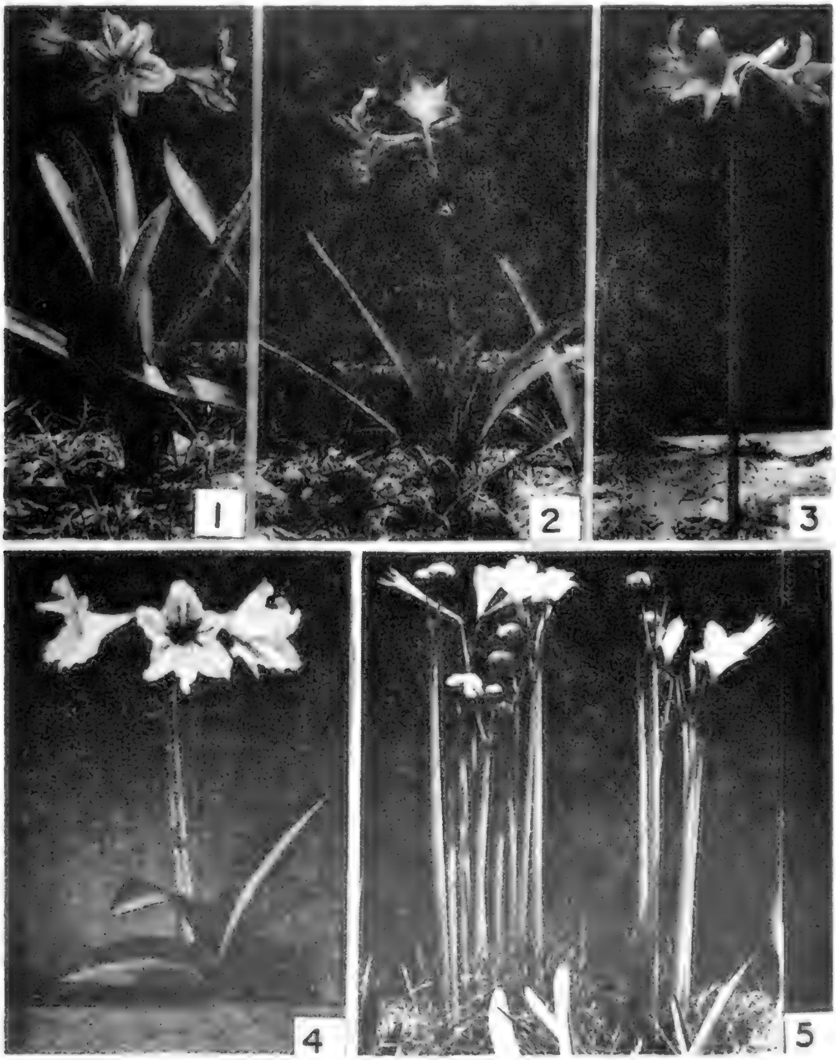

Fig. 6. **Amaryllis** species (1.) **Amaryllis vittata**, (2.) **Amaryllis belladonna**, (3.) **Amaryllis stylosa**, (4.) **Amaryllis reticulata**, and (5.) **Amaryllis** species.

There are nearly 137 cultivars in the National Botanic Gardens, which are neither registered nor are their exact ancestry documented (3, and personal communication). Some of these have been obtained from nurseries in Sikkim and Kalimpong. These cultivars together with the ancestral species form a single complex and their proper classification, though difficult is never the less essential. In this connection it may be stressed that while botanical species need to be classified as per rules of "International Code of Botanical Nomenclature" i.e. using categories like genus, species, subspecies variety and forms, the cultivars should be classified on the basis of 'International Code of Nomenclature for cultivated Plants' based on the cultivar concept (1). A cultivar (cv) is not to be confused with a botanical variety. It is the result of man's selection and "denotes an assemblage of cultivated individuals which is distinguished by any character-morphological, physiological, cytological, chemical or others—significant for the purpose of agriculture, forestry or horticulture, and which, when reproduced (asexually or sexually) retains its distinguishing features" (Article No. 5).

A workable classification of cultivars should aim at stressing the agro-horticultural use, or to fulfil a purpose in field, garden or even in exhibition, than stress discrete botanical differences which is the basis of a botanical classification. From this point of view, the cultivars in NBG have been classified following the system suggested by Traub (4).

1. *LONG-TRUMPET AMARYLLIS HYBRIDS*: Pedicels relatively long, flowers drooping, tepaltube very long (11-15 cm.). Flower like Easter lilies. *Diploids* (2n=22): 'Becon' and 'Sneezy'.

II. *BELLADONNA-TYPE AMARYLLIS HYBRIDS*: Pedicels relatively long, flowers usually drooping but not always so. Tepal-tube shorter than above.

Diploids (2n=22): 'Achilles', 'Adonis', 'Amazon', 'Aphrodite', 'Bashful', 'Beauty', 'Bride', 'Bridesmaid', 'Brilliant', 'Buccaneer', 'Cardinal', 'Cerberus', 'Ceres', 'Coquette', 'Diana', 'Dopey', 'Fresta', 'Flora', 'Glorious', 'Hysperian', 'Itene', 'Jenus', 'Jenny', 'Leo', 'Lucifer', 'Melpomone', 'Mercurius', 'Morpheus', 'Neptune', 'Nesta', 'Olymphus', 'Orion', 'Orthello', 'Percy Lancaster', 'Prima Donna', 'Prime Minister', 'Sleepy', 'Star of India', 'Tara', 'Uranus' and 'Vesta'.

Tetraploid (2n=44): 'Admiral', 'Admiration', 'Aeneas', 'Aetna', 'Alexander', 'Andromeda', 'Apollo', 'Aries', 'Autocrat', 'Beautiful', 'Bridegroom', 'Bright Red', 'Charon', 'Chaste', 'Circe', 'Cordelia', 'Dainty', 'Definace', 'Deepakaul', 'Denslow', 'Dimovd', 'Flame', 'Ganymede', 'Gracilis', 'Hannibal', 'Hayward', 'Heliose', 'Invincible', 'Ivy', 'Juliet', 'Juno', 'Kadam Rasul', 'Lalkilla', 'Maharaja', 'Mars', 'Mary', 'Mentor', 'Meteor', 'Minerva', 'Mother's Day', 'Mount Everest', 'Nizam', 'Peacefulness', 'Perseus', 'Pilgrim', 'Pinkie', 'Plauto', 'Princess', 'Rose Queen', 'Salmon Beauty', 'Saturn', 'Sheba', 'Shiela Kaul', 'Silver Lining', 'Sieren', 'Spitfire', 'Star', 'Starway', 'Styx', 'Sweetheart', 'Venus', 'White Queen', and 'Wyndhan'.

III. *REGINAE-TYPE AMARYLLIS HYBRIDS*: Pedicels usually relatively shorter than the above two. Flowers rather drooping, hori-

zontal, or slightly upright. Moderately open faced. Tepal-tube short.

(a) *Markedly imbricated type: Tetraploids* (2n=44): 'Begum Secundra', 'Black Prince', 'Emperor', 'Glory', 'Gorgeous', 'Prof. Kaul', 'Shah Nazaf', and 'Taurus'.

(b) *Less marked imbricated type: Tetraploids* (2n=44): 'Aurora', 'Charming', 'Day break', 'Edith', 'Enchantress', 'Fiery Bett', 'Grumpy', 'Heba', 'Picture', 'Snow White', and 'Thora'.

IV. *LEOPOLDII-TYPE AMARYLLIS HYBRIDS:* These are similar to III except that flowers are wide open, apparently flatish and held horizontally.

(a) *Markedly imbricated type: Diploids* (2n=22): 'Ida' and 'Sybil'. *Tetraploid* (2n=44): 'Doc'.

(b) *Less marked imbricated type: Tetraploid* (2n=44): Unnamed, (c.v. 35).

V. *SEMIDOUBLE HYBRIDS:* Flowers are semidouble in this group *Diploid* (2n=22): 'Firefly'.

From the foregoing classification, it is clear that most of the cultivars fall in Belladonna group followed by Reginae and Leopoldii groups. These are the most important classes as they constitute the bulk of the cultivars important in the trade.

There are 10 major ancestral species which seem to be involved in the origin of garden *Amaryllis* through rampant hybridization followed by selection (2). Taxonomically they fall as under:

1. *Subgenus*; *Lais*: *A. vittata, A. striata.*
2. Subgenus; *Amaryllis: A. leopoldii, A. reginae, A. espiritensis,* and *A. belladonna.*
3. Subgenus; *Omphalissa: A. leopoldii, A. pstittacina, A. aulica,* and *A. pardina.*
4. Subgenus; *Sealyana: A. reticulata.*

As is clear, these species belong to four out of the five subgenera suggested for the genus by Traub (4) who has also given their diagnostic characters.

ACKNOWLEDGEMENTS

I thank Dr. T. N. Khoshoo, Director, National Botanic Gardens, Lucknow, for guidance and interest in this study. I am also grateful to Late Mr. S. Percy Lancaster for providing the material and Mr. T. K. Sharma for illustrations.

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4. Traub, H. P. 1958. The *Amaryllis* Manual. Macmillan, New York. U.S.A.

II. INTERCHANGE HETEROZYGOSITY IN A. STYLOSA (HERB) SWEET.

This species is a native of Guiana and Northern Brazil and was introduced in England around 1821 (Traub, 1958). The present material came from (Royal) Agri-Horticultural Society, Alipore through the courtesy of the late Mr. S. Percy Lancaster, former Senior Technical Assistant. Earlier it was studied cytologically by Neto (1948) and Mookerjea (1955) and was found to have 2n=22. The present study based on both somatic and meiotic chromosomes shows it to be an interchange heterozyote.

METHODS

Karotype was studied from the fresh roots collected and pretreated with aquous saturated solution of paradichlorobenzine for 3 hrs.

Fig. 7. Mitotic complement of **A. stylosa** (Sat. and heteromorphic pairs are marked). x1250. (1) Mitotic complement of **A. stylosa** (2n=22). (2) Photo-idiogram of **A. stylosa.** Note heteromorphic pairs (V and VIII).

The roots were fixed in 1 : 3 acetic alcohol and heated in a mixture of 1 percent aceto-lacmoid and N Hcl (9:1) for few seconds and then squashed in 1 percent aceto carmine. The individual chromosomes were cut from the enlarged microphotographs and arranged in pairs in the descending order of their length. Karyomorphological analysis was determined according to the standards laid down by Battaglia (1955).

Meiosis was studied from the pollen mother cells after fixing buds in carnoy's fluid for 24 hrs. and then squashed in 1 percent aceto-carmine. Young buds were fixed after sacrificing a large number of bulbs as in *Amaryllis,* pollen mother cells undergo meiosis while the scape is hidden inside the bulbs.

RESULTS

Karyotype: As is clear from the foregoing account and also the studies of earlier authors, that the somatic chromosome number in this species is 22. Four of these have centromeres, nearly in median, 11 submedian and 7 in subterminal position, Fig. 7 *(1-2).* Two subterminal chromosomes possess satellites on short arm and form a heteromorphic pair (VI). Out of the remaining 10 pairs, 8 are homomorphic leaving four chromosomes which can be sorted out in two heteromorphic pairs (Nos. V and VIII).

Meiosis: The normal meiosis of diploids are characterised by 11 bivalents, but out of the 54 cells studied in this taxon only 3.62 show 11 bivalents, while the remaining 96.38% possess an interchange multiple of 4 chromosomes, Fig. 8 *(3-7).* Out of the latter, 94.36% are rings (Figs. 3-6) while only 1.85% are chains, Fig. 8 *(7).* All chains and majority of the rings segregate disjunctionally. The remaining (3.62%) rings are non-disjunctional (Table I). Chiasma frequency per cell ranges from 24 to 26 and average being 24.7±0.45, out of these nearly 17.2 are terminalized at metaphase I. The interchange multiple has generally 4 chiasmata, 3 of which are completely terminalized while one is interstitial, Fig. 8 *(4-6).* In cells with 11 bivalents, there are 10 ring and one rod type and chiasma frequency ranges from 25 to 27, average being 26 per cell.

Anaphases are perfectly normal with 11:11 segregation Fig. 8 *(8).* and subsequent stages of meiosis though perfectly normal result in nearly 56% pollen fertility.

Pollen mitosis: An analysis of pollen mitosis was made. Upon matching the haploid karyotypes from pollen grains, two types are recognizable, which, besides the satellited chromosome, differ in two pairs, Fig. 9 *(9, 11, 10, 12).* Two such karyotypes when compounded. Fig. 9 *(13),* give the diploid karyotype of the *A. stylosa,* Fig. 7 *(2).*

Table - I

Chromosome associations at metaphase I in *A. stylosa*

Associations	Segregations (%) Disjunctional	Non disjunctional
R4 + 9 II	90.74	3.62
C4 + 9 II	1.85	—
11 II	3.62	—

DISCUSSIONS

The consistent presence of one or more configuration of 3 or more chromosomes in otherwise a diploid species may be a marker of the inter-

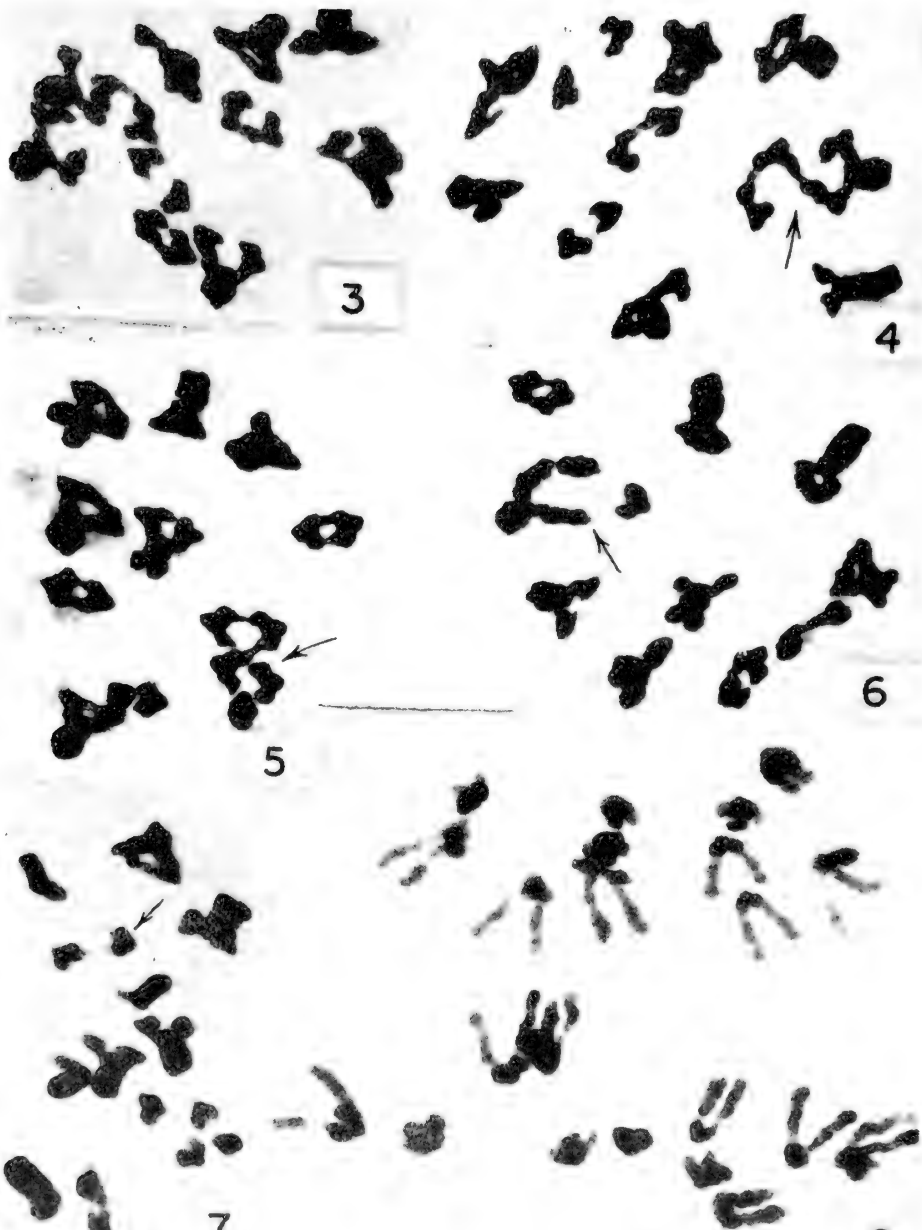

Fig. 8. **(Nos. 3-8).** Male meiosis in interchange heterozygote **A. stylosa** (n=11); (Interchange multiples are marked) x1250; (3.) Homozygote cell, 11 II; (4-6.) R4 + 9 II; (7.) C4 + 9 II; and (8.) Anaphase I, 11 : 11 chromosomes.

change hybridity. This is aptly true of the present taxon in which over 96% cells contain either a ring or a chain of 4 chromosomes plus 9 bivalents. An analysis of the interchange multiple shows that it is composed of four chromosomes, two of which are small and have a centromere in median-submedian position, while the remaining two are long with centromere in subterminal position. The latter often has an interstitial chiasma in the long arm, while the remaining chiasmata are terminal. This tallies with the karyomorphological analysis wherein apart from the heteromorphicity in satellited pair, two other pairs of more or less the above morphology have been identified. The frequency of disjunctional orientation in this interchange heterozygote is far greater (92.99) than those that are adjacent (Table 1) as is the case in a number of interchange heterozygotes like *Campanula* (Gairdner and Darlington, 1931) *Periplenata* (Lewis and John, 1957) *Oenothera*, Rhoeo (Sybenga, 1968), etc. In the present case, the predominant associations are ring multiples and chains occur in about 1.85% cases. These results are in line with earlier findings of Gairdner and Darlington (1931) in *Campanula* and Muntzing and Prakken (1941) and Sybenga (1968) in rye, etc. However, Lewis and John (1963), Khoshoo and Mukerjee (1966) and Zadoo and Khoshoo (1968) observed that alternate disjunction was prevalent only in chains, and rings were always found segregating non-disjunctionally. They attributed it to the small size of rings and greater rigidity in the centromeric regions of small chromosomes which do not permit their centromeres to orientate alternately in the rings. However, such rigidity is lesser in the chains which orient in a zig-zag fashion.

The fertility of an interchange heterozygote largely depends upon number of factors, particularly morphology of chromosomes, nature of interchange multiples, frequency of multiple orientations, their disjunction at metaphase I, presence or absence of interstitial cross overs (Burnham, 1956) and capacity of genotype to withstand rearrangements. (Zadoo and Khoshoo, 1968). Plants with an interchange showing equal frequency of adjacent and alternate orientation have approximately 50% pollen and ovule fertility. This is due to the fact that alternate orientations produce viable gametes, whereas adjacent reduce fertility as they carry deficiency and duplications in the gametes that cause sterility. Therefore, with the increase in the rate of alternate orientation, there will be increase in fertility. However, it is not true in the case of *Bougainvillea* (Zadoo and Khoshoo, 1968) where nearly 80% interchange ring multiples orientated non-disjunctionally but resulted in 65% pollen fertility. This indicates that the deficiencies and duplications caused by non-disjunctional segregation do not cause serious physiological effects on the pollen grains because its genome is capable of withstanding rearrangements. In the present case, 92.59% interchange multiples show alternate disjunction but result in only 56% pollen fertility. The reduced fertility seems to result from the presence of an interstitial chiasma in the interchange multiples, Fig. 8 *(3-6)*, which cause the transfer of larger segments leading to inviability. This agrees with the results of Blakeslee (1927-1928) in *Datura* (Vide

Burnham, 1956) where majority of the ring multiples with a chiasma in the interstititial segments, though with alternate disjunction (a configuration of figure of eight) result in 50 per cent fertile pollen grains.

A survey on the frequency of the multiple associations in the amaryllis heterozygote indicates that the chain associations are lower

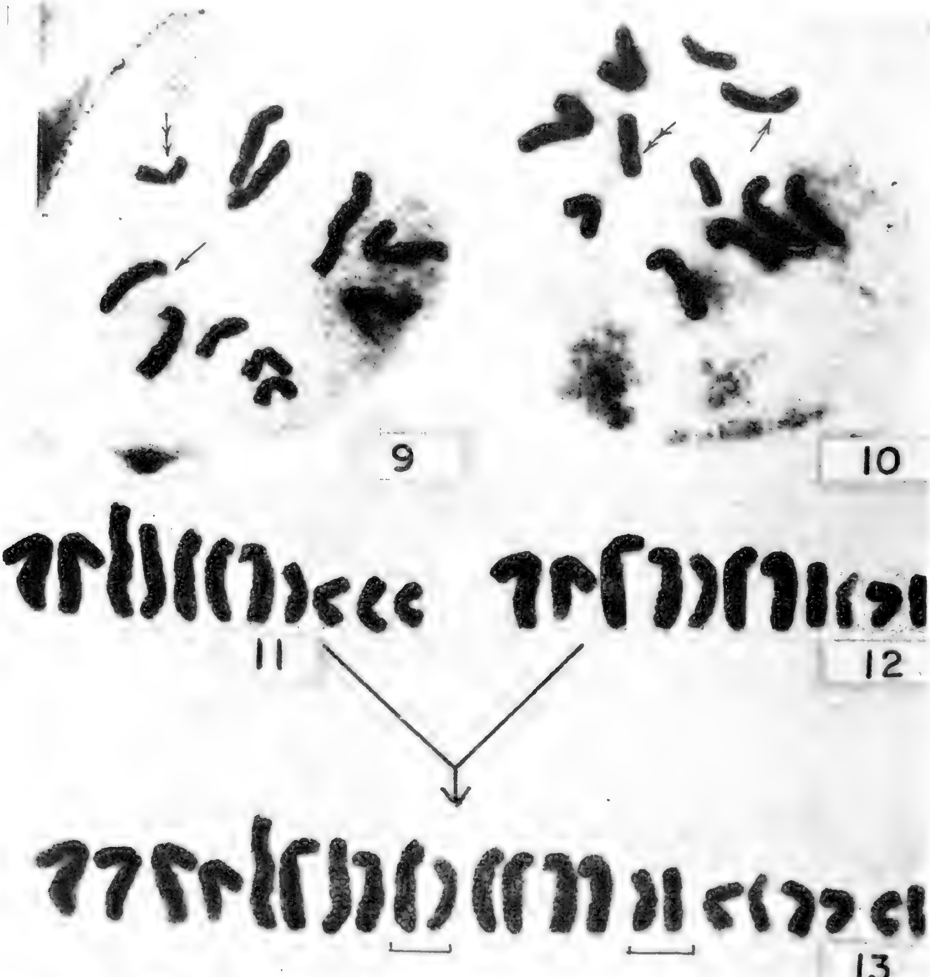

Fig. 9. **(Nos. 9-13)**. Pollen grain mitosis in **A. stylosa** (n=11); (Heteromorphic chromosomes are marked) x112.5; **(9-10)** Pollen grains containing two types of chromosome complements; **(11-12)** Haploid photo-idiograms of the same, and **(13)** The two sets taken together tally with the normal somatic complement of **A. Stylosa** (see Fig. 7) **(2)**.

(1.85) than the rings (94.36%). This may be ascribed to the lack of terminalization in the interchange multiples which prevents a regu-

lar formation of chain. The higher the frequency of alternate orientations in ring multiples, the greater are chances of chains because of shifting of one of the terminal chiasmata.

It is apparent from the karyotypic analysis that 4 chromosomes are non-homologous. These 2 heteromorphic pairs (V and VIII) in this heterozygote apparently fit very well with the occurance of rings or chains of 4 chromosomes. This indicates that only one interchange has been involved in this heterozygote. However, the presence of heteromorphic chromosomes in the interchange heterozygotes of *Chrysanthemum carianatum* could not be found (Rana, 1965-66; Rana and Jain, 1965). Therefore, it is apparent that the karyotypic heteromorphicity is not an essential marker of interchange heterozygosity. The origin of this taxon is not very clear but the heterozygosity is maintained efficiently by propagation.

SUMMARY

Male meiosis of *A. stylosa* has revealed it to be an interchange heterozygote. Meiosis is characterised by formation of a ring or chain of 4 chromosomes and 9 II, in 96.38% pollen mother cells, at metaphase I. The interchange multiple is also karyotypically detectable because of the heteromorphic nature of 2 pairs of chromosomes. Though 92.59% interchange multiples show alternate disjunction yet there is only 56.0% pollen fertility. The reduced fertility seems to result from the presence of an interstitial chiasma in the interchange multiples. However, vegetative reproduction not only conserves high level of heterozygosity but also circumvents high level of sterility.

ACKNOWLEDGEMENTS

I thank Dr. T. N. Khoshoo, Director, National Botanic Gardens, Lucknow, for guidance and interest in this study. I am also grateful to Late Mr. S. Percy Lancaster for providing the material and Mr. T. K. Sharma for illustrations.

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III. CHROMOSOMAL VARIATION

INTRODUCTION

So far nearly 22 species of the genus *Amaryllis* have been studied cytologically by Inariyama (1937), Sato (1938), Baldwin and Speese (1947), Neto (1948), Ficker (1951), Schmidhauser (1954), Mookerjea (1955), Sharma and Jash (1958), Traub (1958), Narain and Khoshoo, (1968), Burnham *et al* (1971) and present report (Table I). The chromosome numbers are clearly indicative of a basic number of 11 which forms a series from 2x through 3x, 4x, 6x to 7x.

In the present case, out of 137 horticultural varieties growing in the National Botanic Gardens, Lucknow; only 50, including species like *A. vittata, A. belladonna, A. stylosa. A. reticulata* and *A. species* and 45 garden cultivars were studied. Thirty were found to be diploids, one triploid and 14 tetraploids. Among the species *A. stylosa A. reticulata* and *A. species* were dipliod, whereas *A. vittata* was found to be both diploid and tetraploid and *A. belladonna* was found to have 3 races namely diploid, triploid and tetraploid.

MATERIALS AND METHODS

The present study is based on 5 species and 45 garden cultivars of *Amaryllis* growing at National Botanic Gardens, Lucknow. Majority of the species and cultivars were introduced by the late Mr. S. Percy-Lancaster from Messers Chandra and Pradhan nurseries, Kalimpong (Sikkim). Besides this a large no. of hybrids raised by Percy-Lancaster (Personal communication) at the (Royal) Agri-Horticultural Society, Alipore (Calcutta) were also added. Further, in absence of a regular name the cultivars were numbered.

Karyotypic analysis was made from root-tip mitosis. Fresh growing roots were collected and pretreated with aqueous saturated solution of paradichlorobenzene at 15°C for 3-4 hours, followed by a thorough wash in tap water and fixation in 1:3 acetic-alcohol for 24 hours. The roots were subsequently heated in a mixture of 1 per cent aceto-lacmoid and N.Hcl (9:1) for few seconds and squashed in 1 per cent aceto-carmine. For preparing Photo idiogram, the individual chromosomes were

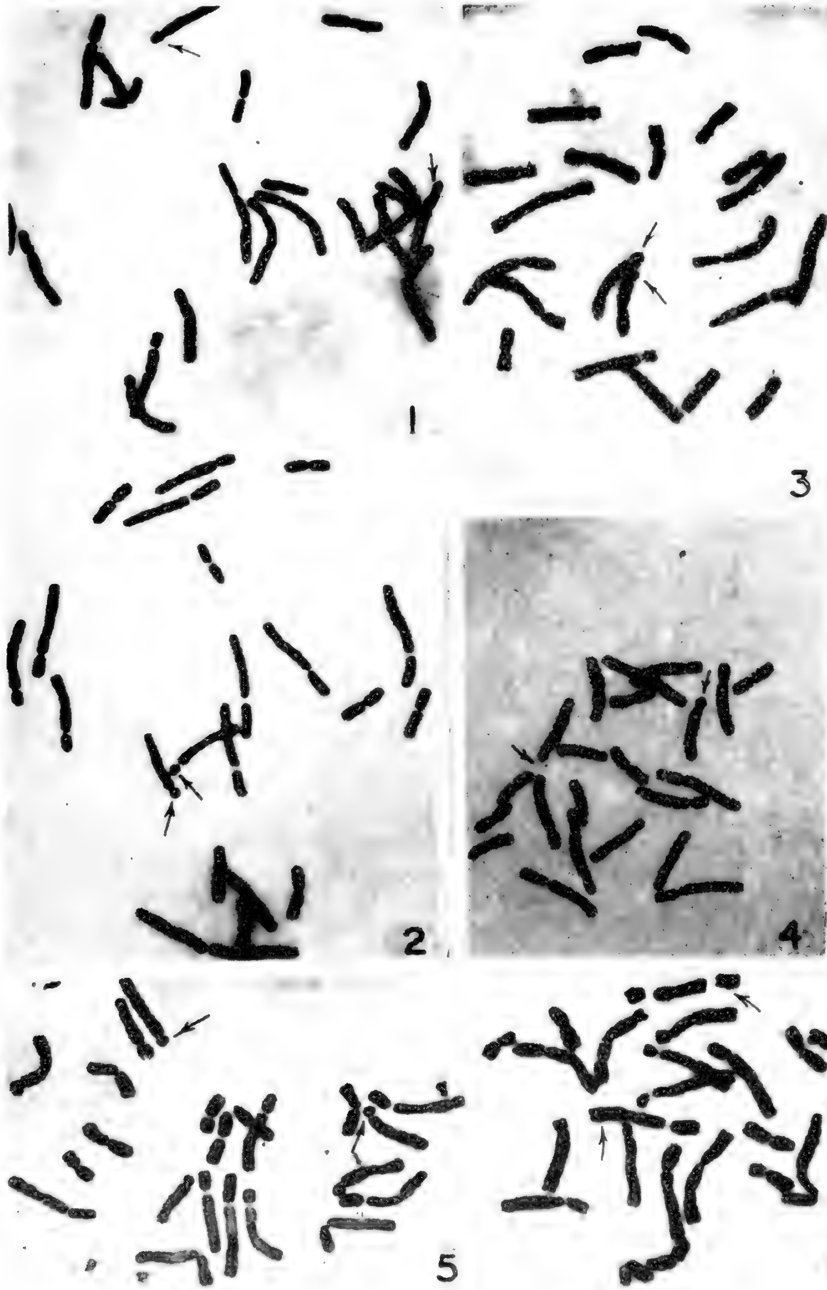

Fig. 10. Mitotic complements of diploid (2n=22) species and cultivars of **Amaryllis** (Sat. pairs are marked): (1) **A. vittata;** (2) **A. belladonna,** (3) **A. reticulata;** (4) **A. species;** (5) cv.131; and (6) cv. 52.

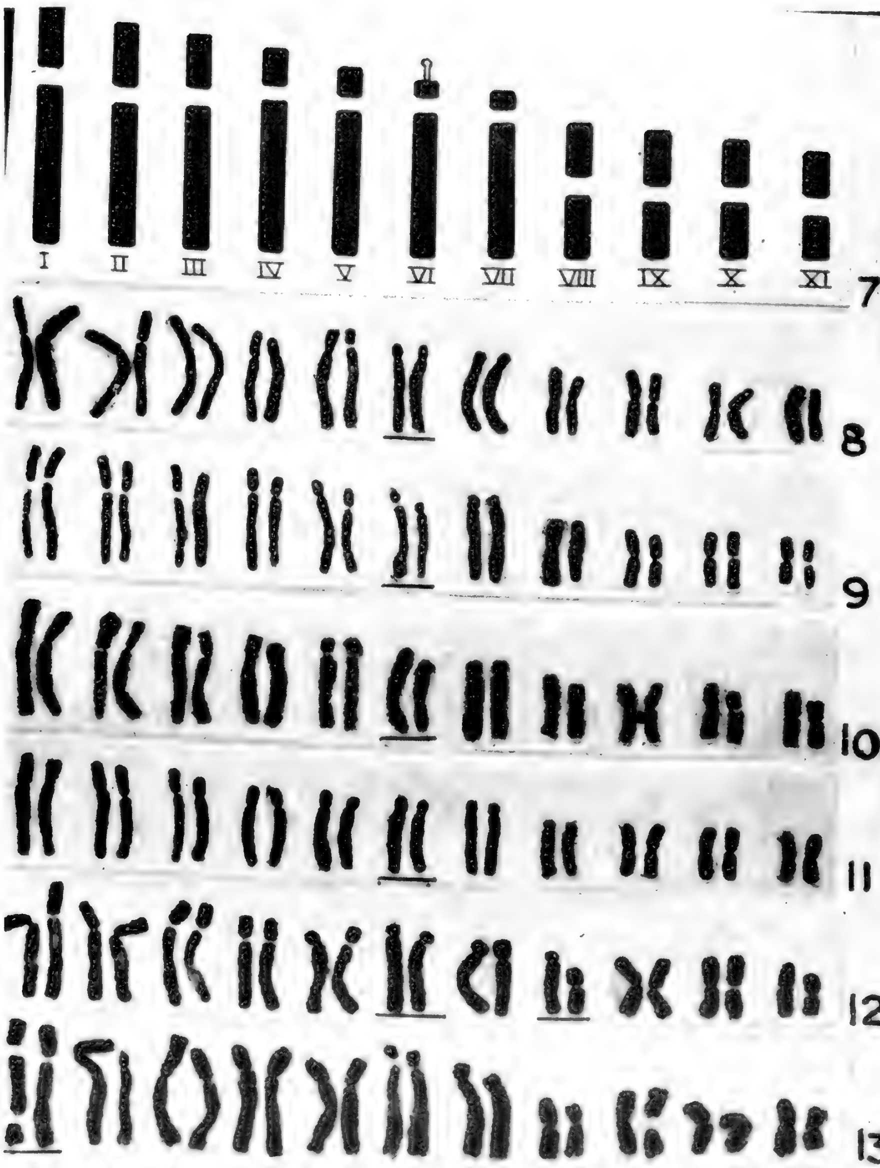

Fig. 11. Photo-idiograms of diploid (2n—22) species and cultivars of **Amaryllis** (Nucleolar and heteromorphic pairs are marked): (7) Idiogram of **Amaryllis;** (8) **A. vittata;** (9) **A. belladonna;** (10) **A reticulata;** (11) **A. species;** (12) cv.131; and (13) cv. 52.

cut out from enlarged photomicrograph, matched and arranged in pairs, whenever possible in descending order of their length. The ratio of long and short arm (L/s) of the chromosome enabled the determination of the centric position. The classification of chromosomes into matacentric (V, 1:1), submetacentric (L, >1:1 - <1:3), subtelocentric (J, 1:3 - <1:0) and telocentric (I, 0:1) was based on the standards laid down by the Battaglia (1955).

Meiosis was studied from pollen, mother cells for which young floral buds were collected and fixed in the carnoy's fluid (Darlington and Lacour, 1947) for 24 hours then stored in 70 per cent alcohol in refrigerator. After 2 days, material was squashed in 1 per cent iron-acetocarmine. In *Amaryllis,* pollen mother cells undergo meiosis while the scape is still hidden in the bulb and bulbs had to be cut in order to fix young anthers, still one was not sure if the proper stages were available. Therefore meiosis could be studied only in those taxa, where good number of plants were available.

RESULTS

Karyotype: Somatic complements of the diploid species, Fig 10 *(1-4),* consist of 22 chromosomes which can be resolved in most cases into 11 pairs. A basic karyotype, Fig. 11 *(7),* containing 2 chromosomes with median (V), 5 with submedian (L) and 4 with subterminal (J) centromeres can be recognized, Fig. 11 *(8-10)*; see Table II. The basic karyotype is shown in Fig. 11 *(7)* and chromosomes have been arranged according to descending order and their length. It is evident from the idiogram that chromosome Types 1, II and III are comparatively long and have submedian (L) centromeres, while Types IV, V, VI and VII possess subterminal (J) centromere but differ in the size of long/short arm ratio (Table II). Furthermore, among the short chromosomes, Types IX and XI possess a median (V) while Types VIII and X submedian (L) primary constriction. In the entire somatic complement of 22 chromosomes, only 2 satellited chromosomes were observed. A detailed analysis of the basic karyotype shows that the species can be divided into 2 groups which differ in the location of centromere in the VIII pair. In *A. vittata,* Fig. 10 *(1)*; Fig. 11 *(8)*; *A. belladonna,* Fig. 10 *(2)*; Fig. 11 *(9),* and *A. reticulata,* Fig. 10 *(3)*; Fig. 11 *(10),* this pair has centromere in median to submedian position, while in *A. species,* Fig. 10 *(4)*; Fig. 11 *(11),* it is highly subterminal in position. Accordingly, the karyotype in *A. belladonna, A. vittata* and *A. reticulata* is rather uniform in comparison to *A. species* and in particular to *A. stylosa.* The last taxon possesses 2 heteromorphic pairs which can be correlated with its being an interchange heterozygote (Narain, 1975).

The size of chromosomes varies in elemental species and cultivars. In the diploids it varies from 4.57 μ to 12.2 μ whereas in tetraploids from 3.71 to 10-67 μ. The longest pair is about 2.6 times longer than the shortest pair in the karyotypes. Sometimes, in most of the taxa, a minor but consistent difference in the size of the two members of a chromosome pair has been noted. This difference in size, whenever,

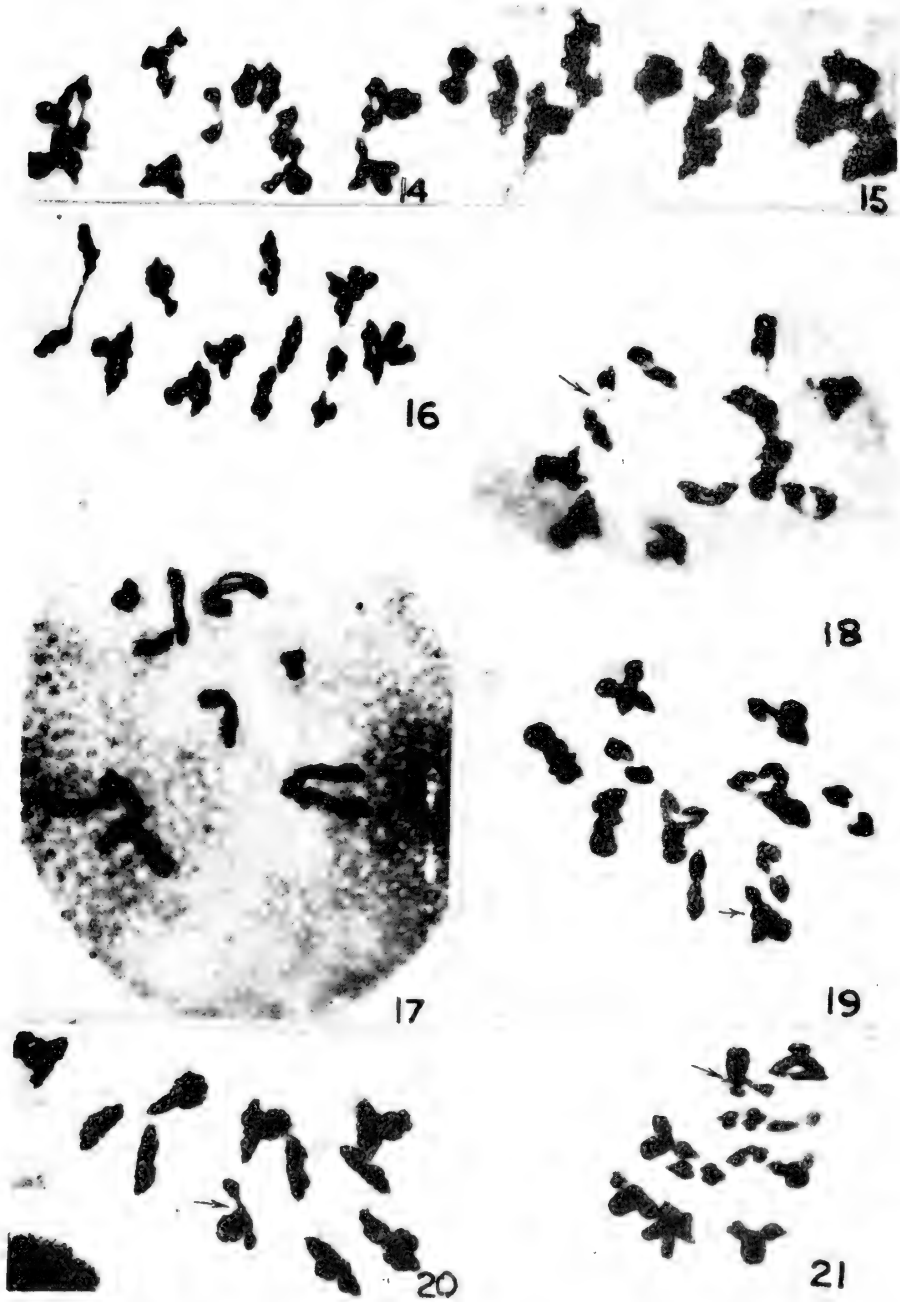

Fig. 12. Male meiosis and pollen grain mitosis in diploid (n=11) species and cultivars of **Amaryllis.** (Heteromorphic bivalents are marked)—(14) **A. vittata** metaphase I, 11 II; (15) **A species** metaphase I, ii II; (16) **A. belladonna** metaphase I, 11 II; (17) Pollen grain mitosis of **A. belladonna** (n=11); (18) cv. 26 metaphase I, 11 II; (19) cv. 18 metaphase I, 11 II; (20) cv. 88 metaphase I, 11 II; and (21) cv. 10 metaphase, I. 11 II.

present was found between the length of short or long arms. Evidently, the long/short arm ratio in the two members of the pair varies to a small but perceptible degree (Table II).

Meiosis: Male meiosis was studied in *A. vittata*, *A. belladonna* and *A. stylosa* and *A. species*. Except in *A. stylosa* which is a translocation heterozygote (Narain, 1975) all the rest show regular meiotic behaviour and 11 bivalents were always observed, Fig. 12 *(14-16)*. The number of ring bivalents varies from 9 to 10, while those of rods from 2 to 1. Chiasmata frequency per cell ranges from 25.3±0.2 *(A. belladonna)* to 21.57±0.34 *(A. vittata)* and 20.0±0.26 *(A. species)* i.e. 2.3, 1.96 and 1.81 per bivalent respectively (Table III). Normal segregation of 11:11 chromosomes at anaphase I was regularly seen and no bridges, laggards or other abnormalities were observed in any species. Anaphase II and tetrad formation was normal with perfect pollen grains. Pollen grain mitosis revealed the occurrence of the expected number and morphology of chromosomes, Fig. 12 *(17)*.

Pollen fertility in the elemental species is fairly high and ranges from 56 to 80% except in *A. species*, which is totally male sterile but fully female fertile. The size of pollen grains varies from 70.3 Ч to 75.04 Ч and number of seeds per capsule ranges from 40-60.

GARDEN CULTIVARS

Forty five distinct horticultural varieties were included in the present investigation. Majority of them are hybrid of complex origin and due to the lack of adequate records, their exact ancestory could not be ascentained. They may be at diploid, triploid or tetraploid level.

DIPLOIDS

Karyotype: Thirty cultivars out of the 45 studied were found to be diploid with 2n=22 in their sematic complements, Fig. 10 *(5, 6)* and Fig. 11 *(12, 13)*. Actual arm ratios have been worked out in 24 cultivars and data are summarised in Table II. The basikaryotype of 4V + 10L + 8J is recognizable only in 29% of cultivars, while in the remaining 71% there is a variable number of V and in particular L and J chromosomes. The number of V chromosomes varied only in 3 cultivars (12.5%), out of which in 2, the number was 2 while in one it was 3 instead of the usual 4. On the other hand, the number of L and J chromosomes varied from 11 to 7 instead of the normal 10L and 8J chromosomes (Table II). Further, the 22 chromosomes do not fall in 11 hemomorphic pairs but there are 1 to 5 heteromorphic pairs (Table II).

Evidently, there is much karyotypic heteromorphicity in the garden cultivars of amaryllis and broadly speaking two groups are recognizable. In one group (e.g. 'Achilles' cv. 52, Fig. 10 *(6)* and Fig. 11 *(13)*, the karyotype though heteromorphic resembles *A. belladonna* type in as much as the VIII pair is composed of chromosomes with median to submedian centromeres. In the second group (like cv. 18) which constitute the, Fig. 10 *(5)*, bulk of cultivars, the karyotype is highly heteromorphic with variable number of V, L and J chromosomes and

VIII pair is always composed of one V or L and the other J chromosomes (Table II).

Meiosis: Since meiosis takes place inside the bulb it could be studied in such cultivars in which there were a reasonable number of bulbs to spare. Nearly 20 analysable pollen mother cells in each cultivar were studied. The data are summarised in Table III. In general,

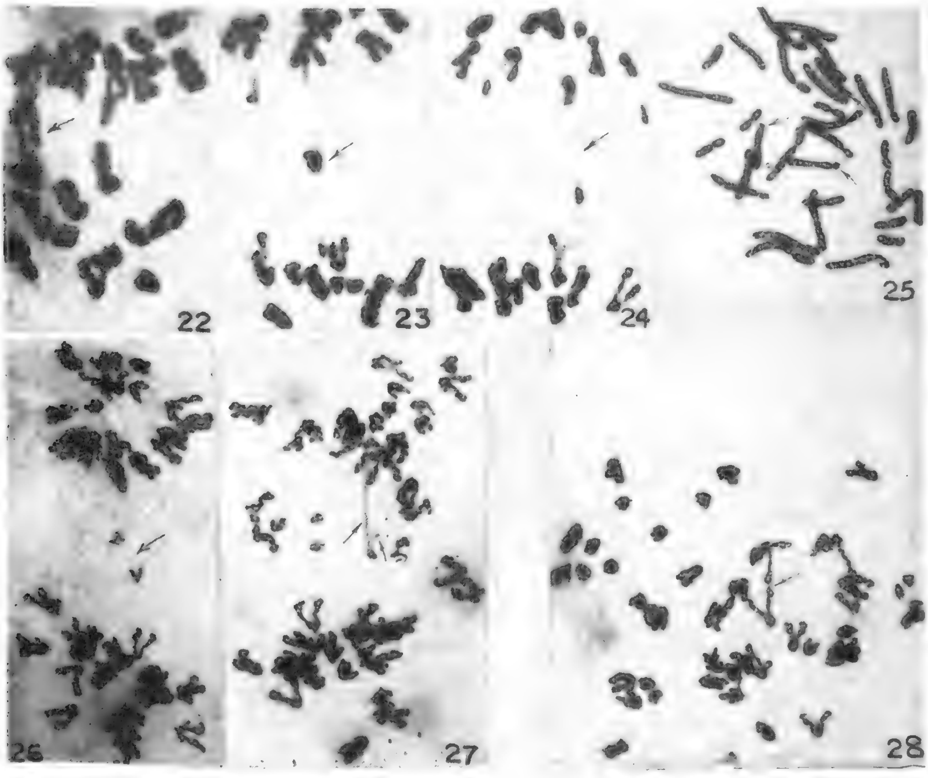

Fig. 13. Male meiosis and pollen grain mitosis in diploid (n=11) species and cultivars of **Amaryllis** (Heteromorphic bivalents are marked): (22) cv. 18. Anaphase I, 11:11 (Note late disjunction of one bivalent); (23) cv. 18. Anaphase I, 11:11 (Note chromosome bridge without fragment); (24) cv. 26. Anaphase I, 11:11 (Note bridge and non termalized Segment); (25) Mitotic complement of triploid (2n=33) cultivar of **Amaryllis** (Sat. chromosomes are marked); (26) cv. 35. Anaphase I, 22:22 (Note precocious division of the bivalent); (27) cv. 1. Anaphase I, 22:22 (Note bridge and fragment), and (28) cv. 16. Anaphase I, 22:22 (Note late disjunction in one IV).

there were 11 bivalents at metaphase I, some of them were rather heteromorphic, Fig. 12 *(18 to 21)*. This is expected on the basis of karyotypic heterogeneity. There is considerable variation in number of chiasmata per cell. The maximum being 27.0 ± 0.42 (which is even more than the species in cv. 17) to 18.4 ± 0.33 in cv. 18, which is one

of the more karyotypically heteromorphic cultivars. Other cultivars fall in between (Table III). There was regular segregation of 11:11 at anaphase I, in most cases. However, cv. 18 was characterised by bridges without fragments, Fig. 13 *(22-24)* and such other abnormalities as laggards. Such bridges appear to be result of nonterminalization.

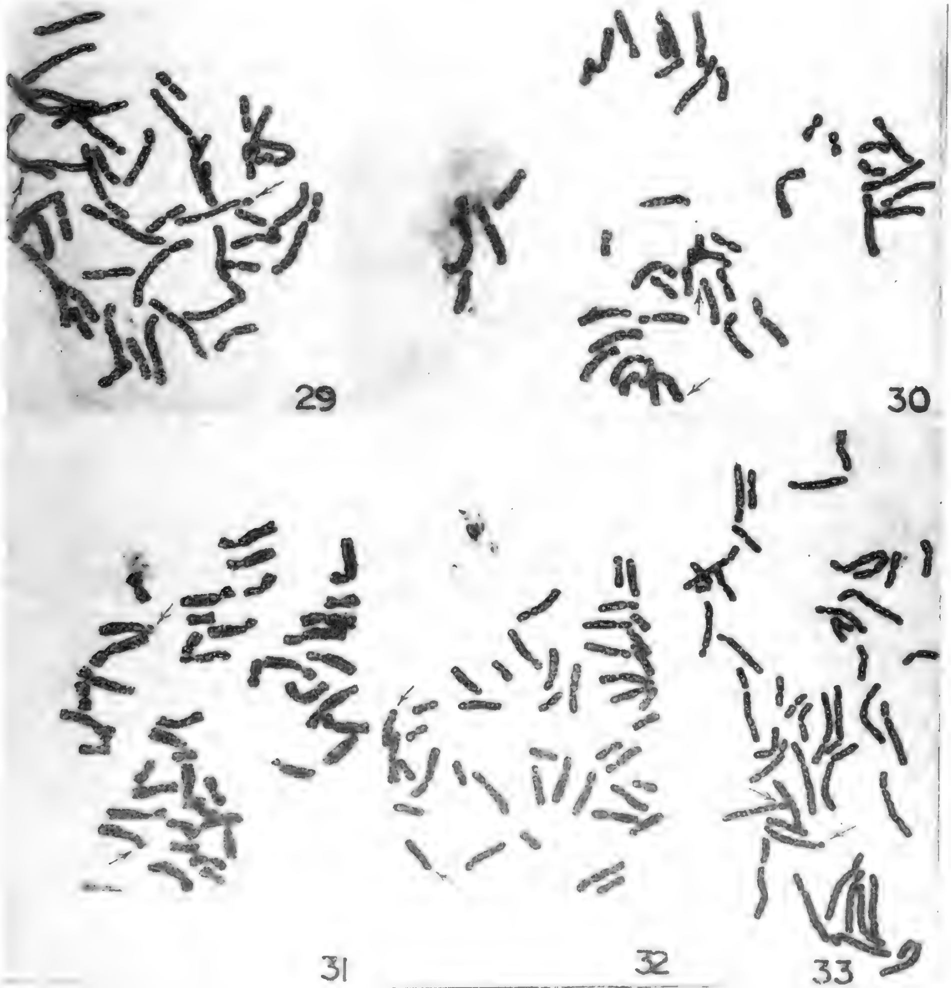

Fig. 14. Mitotic complement of tetraploid (2n=44) species and cultivars. (Sat. pairs are marked): (29) **A. vittata;** (30) **A. belladonna;** (31) cv. 1; (32) cv. 9; and (33) cv. 93.

There is a great variation in the range of pollen fertility which varies from 20.0 to 64.0%. The number of seeds per capsule varies from 15-45 but the germination is poor and very few seeds are viable.

TRIPLOID

Karyotype: Only cv. 110 is a triploid with 2n=33, Fig. 13 *(25)*; the somatic complement of 33 chromosomes is composed of 6V and 15L + 12J chromosomes, Fig. 15 *(34)*; (Table II) indicating that the basic karyotype of 2V + 5L + 4J is represented thrice. However, an analysis of the arm ratio shows that, of the three sets, two are rather homologus and the third differs at least in some of the chromosomes. As expected, there are 3 satellited chromosomes (Table II).

Meiosis: Meiotic analysis of the triploid cultivar has shown a preponderance of trivalent configurations both at diakensis and metaphase I, Fig. 16 *(40-43)*. These range from 11 III to 6 III + 5 II + 5 I, Fig. 16 *(40* to *43)*, Table IV. The former are present in 40% cells. The average number of trivalents is 9.75 ± 0.41 associated with a relatively low number of bivalents (1.15 ± 0.40) and univalents (1.45 ± 0.71). The meiosis has autoploid characters and anaphase I was characterised by unequal segregation, ranging from 16:17 in 80% cells to 15: 18 and 14: 19 in the remaining 20% of cells. Nearly 46% pollen found stainable but the taxon N is otherwise both pollen and seed sterile.

TETRAPLOIDS

Karyotype: Fourteen cultivars including those referable to *A. vittata* and *A. belladonna* are tetraploids (2n=44). Analysis of somatic chromosomes of *A. vittata*, Fig. 14 *(29)* & Fig. 15 *(35)* and *A. belladonna*, Fig. 14 *(30)* and Fig. 15 *(36)*, shows that the basic karyotype of 2V + 5L + 4J is represented four times. However, contrary to the expected number of 4 satellites, there are only 2 satellited chromosomes. These are situated on the short arms of the two subterminal chromosomes. In the remaining 11 cultivars, analysis of somatic chromosomes has shown that the basic karyotype may or may not be recognizable, Fig. 14 *(31* to *33)* and Fig. 15 *(37* to *39)* and Table II. One of the chief reasons for heteromorphicity is that instead of 4 chromosomes of each of the 11 types of chromosomes there may be 2 or 6 (Table II). Furthermore, the arm ratio of a particular chromosome type may differ probably indicating that they came from different parents.

Meiosis: Meiotic analysis of 10 tetraploid taxa has been presented in the Table V. The species and some cultivars possess relatively higher quadrivalent frequency 9.4 ± 0.61 to 5.6 ± 0.26 per cell with a range of 1 to 11. The remaining chromosomes form bivalents, there being no univalents, Table V, Fig. 16 *(44, 45, 47)*. However, on the other extreme, there are cultivars where the frequency of quadrivalents goes down from 4.75 ± 0.32 to 2.8 ± 0.18 per cell accompanied by 4.0 ± 0.20 to 6.4 ± 0.40 univalents, Fig. 16 *(46)*. The range of quadrivalents in the latter is only 2 to 6. These results indicate that while some cultivars show more autoploid characters, others are segmental alloploid in character.

The chiasmata frequency varies from 41.0 ± 0.27 to 48.0 ± 0.46 per cell in the first group, while from 37.6 ± 0.19 to 42.0 ± 0.39 in the latter. The highest number of chiasmata (48.0 ± 0.46 per cell) was

found in cv. 27, which had the maximum average number of quadrivalents (9.4 ± 0.61) per cell; whereas the lowest number was 37.6 ± 0.10 per cell in which case there were 4-8 (6.4 ± 0.40) univalents (Table V).

Quadrivalents and bivalents disjunct regularly at anaphase I while in the cultivars with univalents there is random distribution of univalents which causes a numerical difference in the daughter cells. The lagging univalents have a tendency to divide, Fig. 13 *(26 to 28)*, leading to irregular anaphases often accompanied with bridges and fragments.

Pollen stainability in cultivars with higher frequency of quadrivalents, varies between 80 to 90%, while those with univalents it is from 30 to 54%. Similarly seed setting was much more higher in former than the latter. The size of pollen grains on an average was found to be 101.0.

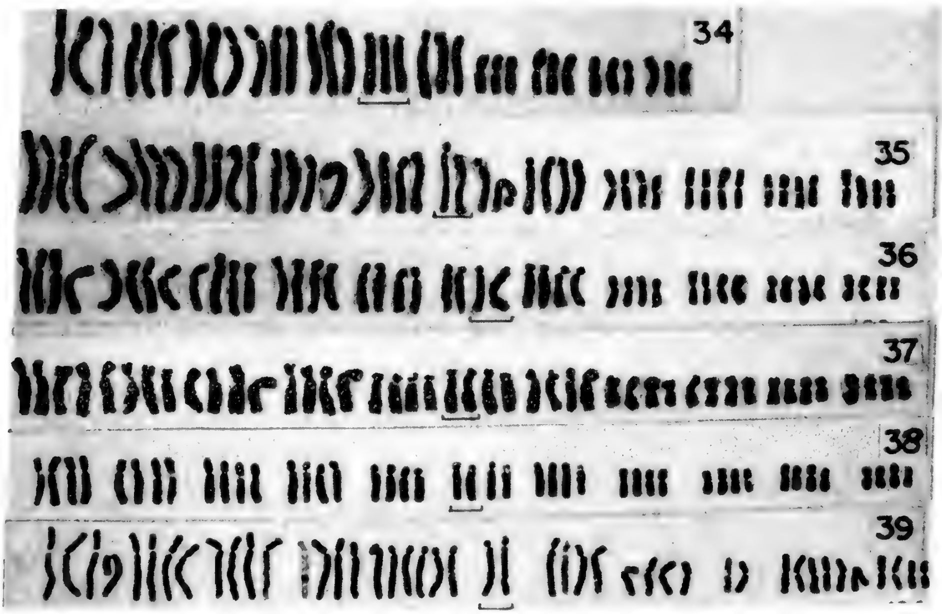

Fig. 15. Photo-idiograms of triploid (2n=33) and (2n=44) species and cultivars: (34) cv. 110 (2n=33); (35) **A. vittata;** (36) **A. belladonna;** (37) cv. 1; (38) cv. 9; and (39) cv. 93.

NUCLEOLAR CHROMOSOMES

Several authors (Inariyama, 1937; Baldwin and Speese, 1947; Ficker, 1951; Schmidhauser, 1954) have not recorded nucleolar chromosomes in *Amaryllis.* Sato (1938) studied *A. vittata* and *A. rutila* and observed only one satellited chromosome in an entire complement of 44 chromosomes. The satellite was situated on the long arm of submedian chromosomes.

In the present investigation, nucleolar organisers in *Amaryllis*

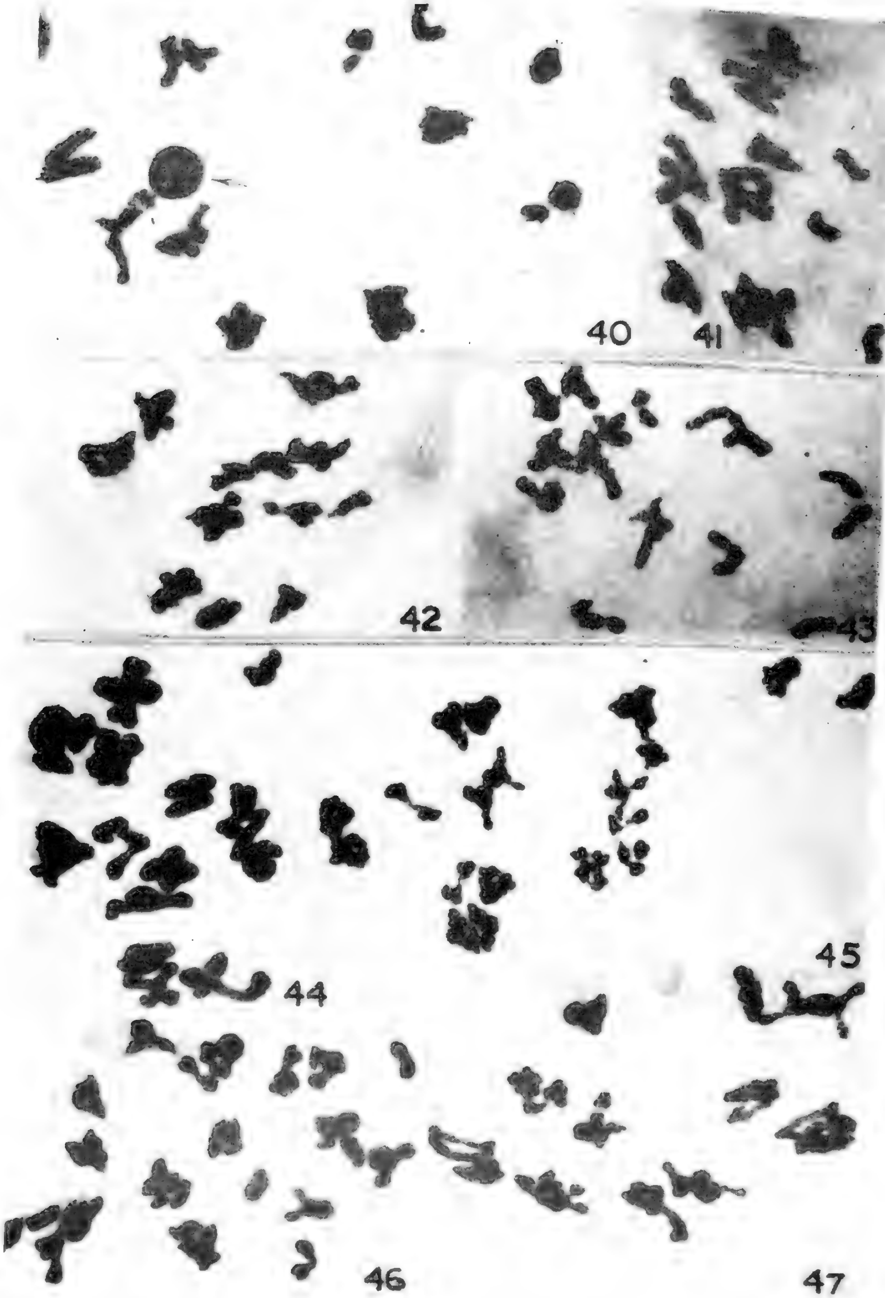

Fig. 16. Male meiosis in triploid (2n=33) and tetraploid (2n=44) species and cultivars of **Amaryllis:** (40) Diakinesis (Note nucleolar 11 III organisor is associated with trivalent); (42) Metaphase I 11 III; (41 and 43) 18 III + 3 II + 31; (44) 27 Metaphase I, 10 IV + 2 II; (45) cv. 25. Metaphase I, 6 IV + 10 II; (46) cv. 1. Metaphase I, 3 IV + 14 II + 4 I; and (47) cv. 16 Metaphase I, 9 IV + 4 II.

species have been observed in the form of both satellites as well as secondary constrictions. Satellited chromosomes were much common being found in the majority of the cultivars and are located on the shorter arms of the subterminal (J) chromosomes.

Mookerjea (1955) and Sharma and Jash (1958) have not found satellites but have observed consistently much higher number (8-9) of secondarily constricted chromosomes. However, in the present investigation, neither in the diploids nor polyploids there were found more than 2 satellited or secondarily constricted chromosomes except in one triploid cultivar where three chromosomes were found with satellites. Furthermore, while the satellites are situated on the short arm of subterminal chromosome, secondary constrictions were found in the longer arms of first pair of chromosomes in cv. 'Achilles', Fig. 10 *(6)* and Fig. 11 *(13)*, with submedian centromere.

DISCUSSION

Out of 67 species belonging to the genus *Amaryllis* 22 have been studied so far cytologically (Table I). In addition, 50 cultivars of garden *Amaryllis* have also been studied. These data are summarised in Table I. to V. A perusal of the same shows that the genus is monobasic (x=11), the polyploids ranging from 3x to 7x are all based on this number. The only exception is *A. aulica* which has 2n=23 (Schmidhauser, 1954). This species evidently may be 2x + 1 in constitution and does not represent a new basic number.

The present results together with some of the earlier accounts (Table I) reveal the existence of a basic karyotype of 11 chromosomes composed of 3 medium to large submedian, 4 medium subterminal and 4 small median to submedian chromosomes. The basis karyotype is often recognizable even at triploid and tetraploid levels. However the only exception is *A. species*, in which case VIII pair is highly subterminal instead of median to submedian in *A. belladonna* and other taxa. Coupled with such a cytological divergence, *A. species* is distinctive because flower is narrow, long and bell shaped in appearance. Tepal tube is very long (8-10cm) and perianth is equal, white and obovate. In contrast, *A. vittata*, *A. belladonna* and *A. reticulata* have flattened open faced flowers, with short tepal tube (1 to 3cm) and six unequal, broad and lancee—ovate to obovate perianth in variable colours. In *A. species* only 2-4 deformed anthers are produced which never dehisce. Filament and styles are shorter and remain inside the perigone. The ovary is normal and produces fruits whenever pollen is applied artificially. The morphological characteristics shows that *A.* species belongs to subgenus *Macropodastrum* of the genus *Amaryllis* (Traub, 1958).

There is also a general decrease in chromosome size with increase in ploidy level. However, at any one level the longest chromosome pair is about 2.6 times longer than the smallest pair in a complement. Decrease in size with increase in level of ploidy has been recorded in a number of genera like *Allium* (Ved Brat, 1965) *Crinum* (Raina and Khoshoo, 1971), etc. According to Darlington (1963) this tendency

helps to resolve nucleolar-cytoplasm ratio near the diploid level and may be due to decrease in level of polynemy (Darlington 1958) or loss of duplicate material.

One of the significant markers in chromosomes is the position of centromere. Based on this, arm ratios were calculated for each chromosomes and Zygotic complements were resolved on the basis of length of chromosomes and the arm ratio. On this basis, complements of the diploid species more often resolved in more or less 11 homomorphic pairs. However, in the complement of many of the diploid cultivars there is a varying number of heteromorphic pairs, often one such pair is nucleolar. Karyotypic analysis of cv. 18 and large number of cultivars (Table II) indicates that they possess an intermediate complement of two basikaryotypes.

Two genomes A (2V+5L+4J) and B (2V+4L+5J) as represented by *A. belladonna* and *A. species* or their allies appear to have been involved in the origin of the cultivars. If the two haploid genomes are compounded, the resultant diploid complement tallies, on karyomorphological grounds, with the karyotype of the cultivars. Karyotypic heterozygosity was also found in the natural populations of *A. elegams (Hippeastrum solandriflorum)* by Baldwin and Speese (1947) and in the five progeny plants they found only one was homomorphic. Such heteromorphicity can easily come about by hybridization involving taxa with chromosomes differing in arm ratios. Alternatively, they may be the result of karyotypic alterations like unequal interchanges involving non-homologous chromosomes or para- and pericentic inversions. An analysis of meiosis of some of the taxa like *A. stylosa* (Narain 1975) shows quite clearly the role of interchanges.

Another important marker of chromosome complement is the number and location of nucleolar organisers, which as shown by the present and Sato's (1938) investigations are generally in the form of satellites located on the short arm of one of the subterminal chromosome pairs. Only in one cultivar ('Achilles') the nucleolar organisers were found in the form of a pair of secondary constrictions located in the long arm of the longest submedian pair of chromosomes. The number of the nucleolar organiser does not increase with the polidy level. In fact, in the triploid taxon 3 chromosomes were satellited, while tetraploids generally retained the same number as the diploids. This together with the karyotypic heteromorphicity may again mean the involvement of hybridization in the origin of the polyploid amaryllis in which case a genome with stronger satellites suppressed the one with a weaker one i.e. the phenomenon of amphiplasty (Navashin, 1934). If such polyploids were autoploid, they would have had a number of nucleolar organisers commensurate to the level of ploidy.

Meiotic analysis of species and cultivars at diploid, triploid and tetraploid levels shows that chromosomes associate as bivalents, trivalents and quadrivalents, respectively. All the diploid cultivars investigated exhibit complete pairing associated with varying degree of sterility. The solitary triploid shows some differentiation into AAB on the basis of karyotypic analysis. Predominant trivalent formation in

triploid and quadrivalents in tetraploids would indicate autoploid characteristics. There are some tetraploid cultivars in which frequency and range of quadrivalents is low, indicating that they may be segmental allotetraploid. That hybridization has been involved in the origin of the diploid, triploid and tetraploid cultivars is well known and is apparent from the karyotypic analysis. However, the character, of meiosis in all the cultivars shows that differentiation between the parental genomes is weak resulting in bivalents in diploid, trivalents in triploid and quadrivalents in tetraploid, cultivars. The only evidence of some difference of genomes is found in a few tetraploid cultivars in which quadrivalent frequency is lower and is associated with increase in number of univalents. It looks that the genomes in this genus have not differentiated, sufficiently so that polyploids, natural or artificial, have still segmental allo-or autoploid characters. Thus external stability of karyotype by way of similar morphology reflects in this case internal homology except in cases like *A. stylosa* where interchanges have taken place.

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Table I. Chromosome numbers in **Amaryllis** species

Species	Chromosome number n=	2n=	Reference
Subgenus I. Macropodastrum			
Amaryllis immaculata	—	22	Schmidhauser (1954)
A. elegans (as **Hippeastrum solandriflorum**)	—	22	Baldwin & Speese (1947)
A. species (Unidentified)	11	22	Present work
Subgenus II Lais			
A. maracasa	—	22	Schmidhauser (1954)
A. striata	—	44	Sato (1938)
var. **crocata**	—	22	Schmidhauser (1954)
A. blossfeldiae	—	44	Burnham et al (1971)
A. vittata	—	44	Inariyama (1937)
			Sato (1938)
			Schmidhauser (1954)
			and Mookerjea (1955)
	11	22	Present work
	22	44	Present work
Subgenus III: Amaryllis			
A. barreirasa	—	22	Schmidhauser (1954) and Traub (1958)
A. belladonna	—	22	Ficker (1951)
			Sharma and Jash (1958)
	—	33	Schmidhauser (1954)
	11	22	
	11 III	33	Narain and Khoshoo (1968)
	22	44	Present work
A. evansiae	—	22	Nelson and Fletcher (vide Traub, 1958)
A. stylosa	—	22	Neto (1948)
			Mookerjea (1955)
	R_4 + 9II	22	Narain (In press)
A. traubii	—	22	Traub (1958)
A. reginae	—	33	Neto (1948)
	—	44	Nelson and Fletcher (vide Traub, 1958)
var. **albertii**	—	22	Schmidhauser (1954)
A. apertispatha	—	66	Traub (1958)
A. yungacensis	—	22	Burnham et al (1971)

Subgenus IV. Omphalissa			
A. aulica var. **aulica**	—	23	Schmidhauser (1954)
var. **robusta**	—	22	Mookerjea (1955)
A. calyptrata	—	22	Neto (1948) and Traub (1958) *
A. fosteri	—	22	Traub (1958)
A. oconequensis	—	22	Schmidhauser (1954)
A. pardina	—	22	Nelson & Fletcher (vide Traub, 1958)
Subgenus V. Sealyana			
A. reticulata	—	22	Sharma and Jash (1958) and present work
A. blumenavia	—	77	Sato (1938)

Table II. Arm ratio and karyomorphology in **Amaryllis** species and cultivars

	L/S Ratio			Karyotypic
Amaryllis	Long	Medium	Short	formula
Diploid species:				
vittata	2.14-2.5	3.5 -7.0	1.0-1.4	10L+ 8J+4V
belladonna	2.14-2.28	4.0 -8.0	1.0-1.12	10L+ 8J+4V
reticulata	2.28-2.66	3.5 -8.5	1.0-1.5	10L+ 8J+4V
stylosa	2.2 -2.83	2.11-5.66	1.0-1.33	11L+ 7J+4V
species	2.16-2.4	3.0 -7.33	1.0-6.0	8L+10J+4V
Diploid cultivars:				
cv.5	2.33-3.0	3.0 -7.5	1.0-1.5	10L+ 8J+4V
cv.10	2.0 -2.75	2.8 -7.0	1.0-7.5	11L+ 7J+4V
cv.11	2.0 -3.25	2.25-6.5	1.0-1.5	10L+ 8J+4V
cv.8	1.86-2.8	3.25-7.0	1.0-1.75	20L+16J+8V
cv.9	1.6 -2.2	3.0 -3.6	1.0-1.3	20L+16J+8V
cv.16	2.2 -3.66	3.3 -5.0	1.0-1.33	16L+20J+8V
cv.35	2.6 -2.8	3.28-6.5	1.0-1.5	18L+18J+8V
cv.80	2.3 -2.4	3.25-6.0	1.0-1.5	20L+16J+8V
cv.Andromeda	2.2 -4.0	2.5 -5.5	1.0-1.71	20L+16J+8V
cv.13	1.05-4.2	1.8 -7.0	1.0-7.0	11L+ 9J+2V
cv.17	2.5 -5.33	3.0 -9.0	1.0-5.5	10L+ 8J+4V
cv.18	1.5 -6.0	3.5 -6.5	1.0-5.0	9L+ 9J+4V
cv.19	2.22-3.4	3.4 -6.66	1.0-7.0	9L+ 9J+4V
cv.20	2.5 -3.5	2.4 -6.5	1.0-6.0	8L+10J+4V
cv.23	2.3 -3.0	3.0 -5.00	1.0-5.0	9L+ 9J+4V
cv.26	2.28-3.75	2.6 -7.5	1.0-5.5	9L+ 9J+4V
cv.33	2.00-5.0	2.4 -6.0	1.0-5.3	8L+10J+4V
cv.38	2.4 -6.5	5.0 -6.5	1.0-5.33	7L+11J+4V
cv.52(Achilles)	2.6 -7.0	2.8 -8.5	1.0-1.5	10L+ 8J+4V
cv.53	1.85-3.33	2.4 -6.5	1.0-1.66	11L+ 7J+4V
cv.62	2.14-3.5	4.5 -8.0	1.0-6.5	8L+10J+4V
cv.86	2.0 -2.8	3.0 -7.5	1.0-1.5	10L+ 8J+4V
cv.87	2.3 -2.5	3.2 -7.5	1.0-5.0	9L+ 9J+4V
cv.88	1.67-3.4	3.0 -8.0	1.0-5.0	8L+11J+3V
cv.99	2.16-3.25	2.4 -6.5	1.0-6.0	8L+10J+4V
cv.107	2.28-2.83	1.16-9.0	1.0-5.0	10L+ 8J+4V
cv.109	1.5 -3.2	2.25-8.5	1.0-5.0	7L+11J+4V
cv.123	2.11-3.0	3.0 -7.0	1.0-5.0	7L+11J+4V
cv.131	1.6 -3.3	3.0 -6.0	1.0-6.0	8L+10J+4V
cv.132	2.0 -2.6	3.0 -6.5	1.2-5.5	11L+ 9J+2V
Triploid cultivar:				
cv.110	2.12-2.8	1.5 -8.5	1.0-1.5	15L+12J+6V
Tetraploid species:				
vittata	2.42-2.8	3.0 -6.0	1.0-1.4	20L+16J+8V
belladonna	2.2 -2.85	3.6 -5.0	1.0-1.6	20L+16J+8V
Tetraploid cultivars:				
cv.1	1.2 -2.7	3.0 -4.5	10.0-1.3	20L+16J+8V
cv.2	1.6 -2.8	3.5 -8.0	1.0-1.3	20L+16J+8V

Table III. Meiotic analysis of diploid species and cultivars of Amaryllis

Amaryllis	Total number of cells	Number of Xta per cell Range	Number of Xta per cell Mean	Terminalization coefficient
vittata	20	16-25	21.57±0.34	0.52
belladonna	20	24-27	25.3±0.23	0.67
stylosa	20	24-26	24.7±0.45	0.69
species	20	18-24	20.0±0.26	0.38
cultivars				
cv.10	20	20-30	26.8±0.24	0.66
cv.12	20	22-27	25.8±0.40	0.72
cv.17	20	25-30	27.0±0.42	0.73
cv.18	20	15-21	18.4±0.33	0.65
cv.19	20	23-27	25.0±0.39	0.68
cv.26	20	22-30	26.8±0.29	0.56
cv.87	20	20-25	20.8±0.27	0.73
cv.88	20	21-24	23.5±0.22	0.75

Table IV. Chromosome associations at metaphase I in triploid cultivar (cv. 110).

Associations	Combinations observed						Total number	Average number
Trivalents	11	10	9	9	8	6	390	9.75±0.41
Bivalents	—	1	2	1	3	5	46	1.15±0.40
Univalents	—	1	2	4	3	5	58	1.45±0.71
Number of cells	16	8	6	4	4	2	40	—

Table V. Meiotic analysis of some tetraploid species cultivars of **Amaryllis**

	Chromosome associations						
	Quadrivalents		Bivalents		Univalents		
Amaryllis	Range	Mean	Range	Mean	Range	Mean	Xta frequency per cell
Tetraploids species:							
vittata	6-11	9.4±0.61	2-1	3.2±0.20	—	—	48.0±0.46
belladonna	8-10	9.2±0.19	2-6	3.6±0.41	—	—	45.0±0.29
Tetraploid cultivars:							
cv.16	7-9	8.8±0.79	4-8	4.4±0.17	—	—	46.8±0.24
cv.25	3-9	7.0±0.37	4-16	8.0±0.11	—	—	41.0±0.27
cv.21	4-8	6.2±0.46	6-14	8.6±0.25	—	—	47.5±0.40
cv.8	2-11	6.1±0.21	2-18	9.8±0.26	—	—	45.0±0.51
cv.39	2-11	5.6±0.26	2-18	10.8±0.61	—	—	44.3±0.62
cv.35	4-6	4.75±0.32	9-12	10.5±0.26	2-6	4.0±0.20	42.0±0.39
cv.1	3-4	3.4±0.43	12-14	13.0±0.34	4-6	4.4±0.18	40.0±0.21
cv.2	2-4	2.8±0.18	12-15	13.2±0.13	4-8	6.4±0.40	37.6±0.19

GILLIESIEAE LACK ALLIACEOUS SCENT

Under date of December 19, 1976, Dr. Otto Zoellner writes from Chile that he is familiar with the Genera *Gilliesieae*, *Miersia*, *Gethyum*, and *Ancrumia* of the Tribe Gilliesieae, and he has not observed the presence of the alliaceous scent in these plants. He has promised to send bulbs of *Miersia* sp.

3. GENETICS AND BREEDING

MORE POTENTIALS IN AMARYLLIS BREEDING

William D. Bell, *Miami, Florida*

SPECIES HYBRIDIZATION

Through the years, an amazingly diverse group of *Amaryllis* species has been described. It is equally amazing that with this wealth of diversity, so few of the species have been incorporated into the makeup of the commercial hybrids. But, most of the species are diploid whereas the widely available hybrids are nearly uniformly tetraploid, so a genetic barrier exists for the easy incorporation of new germ plasm. Triploid hybrids can be made and used for further breeding, but the genetic potential of the diploid species is diluted rapidly by this method (*1*).

Breeding among the species is easy. By ordinary refrigeration, freshly shed pollen will generally remain viable throughout the spring breeding season. The chief frustration is that most species have incompatibility factors in seed set, so a smaller percentage of successful crosses result than when pollinating the tetrapliod hybrids. However, by repeating the pollinations daily as long as the style remains firm, a success rate of over 50% can be achieved. When pollen can be obtained from more than one clone of a species, the success rate is even higher. Tetraploid hybrids can usually be self pollinated. Only a few species and species hybrids set seed in this way. Two examples are *Amaryllis reticulata* and *A. papilio*, but the hybrid between these species was self sterile.

Hybridization among the diploid species offers a number of advantages. Seeds are usually smaller than those of the larger hybrids, but if planted soon after ripening, flowering plants can often be obtained in 18 months. Space for breeding is usually at a premium, so a more diverse group of seedlings can be grown in the space taken by the larger hybrids. And, in a mass planting, the smaller hybrids are as showy as their larger counterparts. Even the windowsill gardener can be a successful plant breeder with the diploid *Amaryllis*. Many of the species hybrids can be flowered in a 4- or 5-inch pot. The Korsakoff hybrids (2) are ideally suited for this purpose.

Perhaps you may think that 2 or 3 years are too long to wait for the results of *Amaryllis* hybridization. The solution is a simple one. Start seedlings for 3 successive years. Or, obtain some started seedlings from an established breeder. This is a certain path to an addictive hobby. One cannot stop with the flowering of the first species hybrid. Freshly shed pollen is easily mailed and maintains viability when refrigerated on arrival, so the next step is to seek pollen from other breeders for your special hybrids. Contributors to PLANT LIFE are usually eager and willing collaborators in this venture. When a choice plant flowers, it can produce progeny a hemisphere away—by air mail.

It must be noted that a few species hybrids display low fertility and often will not set seeds. The cytology of this condition might provide us with clues to using these plants more efficiently in breeding. If scant pollen production is associated with the low fertility, one can often obtain good seed set by applying the pollen to a more fertile plant. If only a few per cent of the pollen grains are viable, these are often sufficient for good seed set whereas a like proportion of infertile ovules can result in abortion of the entire seed capsule. Because of this, one can sometimes get good seed yields on a tetraploid using pollen produced on a triploid. *Embryo culture* can sometimes be used to advantage to produce hybrids between 2 plants of low fertility.

The *Amaryllis* species offer excellent opportunities for the study of inheritance patterns. Traits of diploids are mathematically simpler to evaluate than those in a tetraploid population. Although there is some variability in species material, plants from wild sources are usually sufficiently uniform in genetic characters that some predictions can be made of traits expected in the primary crosses. With a record of the pedigree of the species hybrid, predictions can be extended to the following generation with some degree of accuracy. The unpredictable surprises add to the fun of plant breeding.

FLORAL PIGMENTS

Most floral colors in *Amaryllis* have been reported to be determined by the presence or absence of 2 anthocyanin pigments (*3*). These are the water-soluble pigments located almost exclusively in the epidermal layer of the floral parts. The cyanidin (pink to rose) component appears to be dominant over pelargonidin (salmon to scarlet), following the inheritance pattern reported for other plants (*1*). Expected classic ratios were obtained in crossing diploid *Amaryllis* with these floral colors. All of the primary crosses I have flowered of *A. reticulata* have had rose to rose-lavender flowers. Using pollen of a backcross, *A. reticulata* x 'Mrs. Garfield,' progeny produced from a salmon-flowered seed parent (Goedert's SA63-17) were pink or salmon in a 1:1 ratio. A sibling of this pollinator could yield all pink flowers or the same ratio in this cross. Since 'Mrs. Garfield' is a hybrid of *A. reticulata*, it appears that one of the other species in the background of this hybrid had the genetics for salmon flowers. Scarlet and deep rose are probably intensity variants of the identical pigments, but further evidence is required to substantiate this.

Yellow or green are the result of a different pigment system, plastids in the sub-epidermal cells of the floral segments. Four species have been of interest in breeding for yellow flowers, *A. evansiae*, *A. aglaiae*, *A. parodii* and *A. anzaldoi*. Progeny from crosses among the above have flowers of a pale yellow color. The yellow is masked in crosses of these species with others containing anthocyanins in the epidermis. An induced tetraploid form of *A. evansiae* has flowered, but the pigmentation is visibly no deeper than that of the original diploid species.

The limit of yellowness has probably been reached for hybrids

restricted to the 4 species above. To enhance yellowness, one must seek to increase the number of plastids in the floral segments. Green flowers, which also contain the plastids, and those species with a prominent green or yellow throat marking are logical choices for this breeding program. Preliminary evidence from crosses made by several breeders suggests that yellowness vs. greenness is not a simple dominant recessive inheritance pattern. Hybrids of *A. evansiae* x *cybister* generally have an overall color effect between the parent species. Among species to be considered would be *A. fosteri* and the others with bright yellow throats. Then, at least 2 generations will be required to minimize the anthocyanins (*A. evansiae* has the genetic potential for salmon flowers, but the pigment is restricted). However, delightful sunset combinations of the 2 pigment systems appeared in the cross (*A. evansiae* x *yungacensis*) x (*A. evansiae* x *cybister*). In *A. reticulata*, there seems to be a factor inhibiting plastid content in the inflorescence. A 10x or 20x hand lens is a useful tool for inspecting pigment distributions in the floral segments.

FOLIAGE

Foliar pigments in higher plants are surprisingly uniform in composition and proportions. The few exceptions in healthy plants are usually mutations with a lighter than normal green color. One can question the term healthy since these plants are, as a rule, less efficient in the photosynthetic process.

In *Amaryllis*, there is a species, *A. reticulata*, with leaves visibly a deeper green than other species. This appears to be a difference in leaf structure rather than pigmentation. This species has few, if any, stomata or pores on the upper leaf surface. All of more than a dozen primary hybrids of this species had stomata on the upper surface and were of the lighter green color associated with other species.

The white midrib leaf stripe of *A. reticulata* var. *stratifolia* acts as a simple dominant gene with modifiers for the shape and intensity of the stripe. One of the few species to produce seeds by self pollination, a selfed plant yielded progeny in the ratio of 3 striped: 1 plain green. In recent crosses, plants of this variety of the species, visibly similar for the stripe, yielded either 50% or 100% in hybrids. The primary hybrids also yielded 50% striped progeny when crossed with non-striped plants.

FLORET NUMBER AND THE SCAPE

Higher floret number appears to be dominant, but not inherited as a simple trait in the classic ratios. Useful here as breeding material for high floret number are such species as *A. cybister*, *A. fosteri*, *A. angustifolia* and *A. reticulata*. Even the second-generation hybrids of *A. cybister* tend to retain the high floret number. In 30 of the latter involving other species which usually have only 2 florets, only 4 had the low floret number.

A trait considered undesirable for pot plants is the long scape length found in species such as *A. cybister*, *A. angustifolia* and *A. fosteri*. The hybrids *A. evansiae x cybister* had the tall scapes of *A. cybister*, but succeeding generations of these varied in scape length. Again, no clear pattern of inheritance was noted.

Flowering season also appears to be controlled by multiple factors. But, with pollen storage and the occasional off-season bloom, hybrids can be made with the few which are autumn flowering with the vast majority which flower during the spring months. Hybrids of *A. reticulata* are useful for autumn flowering (5) but seem to inherit the lack of hardiness of this species. I have recently crossed a hybrid of *A. reticulata* with a hybrid of *A. aulica* in an attempt to recover autumn flowering in a more hardy background.

The species have definite adaptations to flowering during the optimal environmental conditions in their native habitats. Among crosses involving species which flower during dfferent seasons, we can expect to find plants which will extend the flowering season. Again, several generations may be required to obtain the proper combinations. This may also be the path toward repeated flowering during a single season. Carbohydrate storage in the bulb is usually adequate for more than one flowering per season.

Related to the flowering season is the selection which has taken place in the breeding of existing hybrids. Most hybrids of European origin have been bred for relatively cool greenhouse conditions. These hybrids and some of the species probably do not receive enough winter chilling for reliable flowering in areas like South Florida. An objective in a breeding program must be a selection among hybrids for local growing conditions.

Nodding or down-facing florets probably protect the pollen and stigma from rain in the native habitats of species which display this trait. However, this is not considered desirable in pot plants if it can be eliminated by breeding. This is a characteristic of *A. reticulata* and, unfortunately, of many of its hybrids. But, selections which are 1/4 or 3/16 *A. reticulata* have some of the desirable traits of this species with flat-facing florets.

GENERAL CONSIDERATIONS

Polyploid induction must be encouraged. Many attempts resulting in failures are probably because the treated material was already tetraploid! The large tetraploid hybrids came about through the use of natural tetraploids, but as noted earlier, this excluded much diploid germ plasm from the gene pool of these hybrids. It is worth repeating that much of the genetic potential of the diploid species remains to be utilized.

Primary crosses are sometimes a disappointment. After waiting perhaps 3 years for flowering, anticipation has risen to lofty heights. This has been especially true of hybrids of *A. evansiae*. This species has factors which seem to dilute the anthocyanins of other species. Re-

member, though, that such hybrids have the breeding potential of the parent species plus the recombination of their traits.

A breeding plan which I favor is to cross species *a* with *b* and *a* with *c*. Then cross (*a* x *b*) x (*a* x *c*). If species *a* is *A. angustifolia*, this tends to concentrate a desirable trait such as the *Sprekelia*-like floret in a new background with hybrid vigor and adaptions to new growing conditions. This may be quite important in species like *A. angustifolia* because this species seems to be nematode susceptible. Primary hybrids of this species can be flowered with comparative ease, but few growers have flowered the true species . Such a plan seems suited for breeding for the showy blotch of *A. papilio*. The plan might be for more than 2 florets per scape and different colors of the floral marking.

The plea must be made to maintain the species in their original forms. Hybridization tends to concentrate some germ plasm while some is lost, especially through inbreeding. It is important to maintain more than one clone of a species so that, if necessary, the species can be seed propagated to eliminate virus. The amateur gardener can help to maintain the species. I was unsuccessful in locating a source of *A. andreana* in Colombia and understand that other species may soon no longer exist in their original habitats. We take almost for granted that our food crops will always be available at the local market. But germ plasm resources have saved our major grain crops on a continuing basis. Our conservation efforts must also include our ornamentals before it is too late.

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A VARIEGATED **ALSTROEMERIA LIGTU**

DONALD D. DUNCAN, *Chairman, Alstroemeria Committee, R1, Box 309, Sumner, Washington 98390*

Two years ago in a group of *Alstroemeria ligtu* hybrid seedlings I spotted one that appeared to have variegated foliage. This seedling was later planted out in the ground and well marked in order to keep track of it. The plant continued to grow and produce more variegated leaves through that first season but did not flower.

This past spring I anxiously waited for the first leaves to push through the cool damp earth. To my delight the plant was even more beautiful than the year before. The foliage stems, that appear first, were much more abundant this year and the edge of each leaf was marked with a narrow band of creamy-white, making a very attractive and unusual sight.

Fig. 17. A variegated form of **Alstroemeria ligtu.**

The leaves on the flower stems that popped up a few weeks later showed no variegation at all. The flowers that were produced looked normal in every way, showing no signs of variegation, streaking, or mottling. The color of the flower was a medium pink, pretty, but of no special merit. It set a fair number of seed this summer and I am eager to learn whether or not the progeny will exhibit the same variegation.

I feel that there must be many of you growing Alstroemerias who have also had interesting and unusual variants in your seedlings and I would greatly like to hear from you. Also, I wish to hear from more of you who are growing various species of *Alstroemeria* so that I can compile a list of *Alstroemeria* species in cultivation. If you do not know what species you are growing, please write anyway and describe the growth habit, type of flower, color, blooming time, etc. If possible, include a photo and/or a pressed specimen of the foliage and the flower and I will do my best to identify it.

ALSTROEMERIA X DAVISIAE

Donald D. Duncan, *Chairman, Alstroemeria Committee,*
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After several years of trying to cross *A. pelegrina* and *A. pulchella*, **I have** been successful. The resulting hybrid is a robust plant with a flower of good color, substance, and size.

This beautiful new flower is being name *Alstroemeria* x *davisiae* in honor of Catherine Mills Davis of St. Paul, Minnesota, who has been a life long plant lover and active garden club participant. Her son and

Fig. 18. **Alstroemeria** x **davisiae. (lower left and right)**, a cross between **A. pulchella** ♀ **(upper left)** and **A. pelegrina** **(upper right)**. Reproduced from color photos.

daughter-in-law, Mr. and Mrs. Frederick W. Davis, are close friends of mine and have given me much help and encouragement over the years.

The flower is approximately 2 inches (5cm) long and 1⅜ inches (3.5cm) wide. It is a blending of both parents, taking on much of the color of *A. pelegrina* and the spots and streaking of *A. pulchella*. It is much less tubular than *A. pulchella* but not nearly so spreading as *A. pelegrina*. The color of the flower is nearest to 69-A (red purple

group) with the blotch on the two outer petals being nearest to 73-A (red purple group) and the upper two petals show a pale yellow blotch close to 8-C (yellow group), when compared with the Royal Horticultural Color Chart.

The plant itself, grown in a ground bed in a fiberglass greenhouse under cool house conditions, reaches a height of 3 feet (91 cm). I have yet to test *A.* x *davisiae* outside and realize that the color, height, and hardiness have yet to be determined in the open. It would seem safe to assume that in mild climates it would survive most winters. Within the next few years the plant will be tested outside.

Fig. 19. **Amaryllis** hybrid, clone 'Osceola'; apparently of **Amaryllis reticulata** L'Herit. ancestry (the other parents involved unknown) which blooms in February and again in June—a repeat-bloomer.

A REPEAT BLOOMING HYBRID **AMARYLLIS**

MRS. GLADYS HURT JONES, *308 Barbourville Drive, Tallahassee, Florida 32301*

I was first introduced to benlate by Mr. Eugene Ellis of Tallahassee Nurseries. In 1972, he advised that I use a combination of benlate and isotox to spray my roses for fungus and insects. The solution worked so well, I began using benlate for many of my flower problems. One of

my *Amaryllis* flower scapes was almost eaten through with red blotch. I made a paste of benlate and water and painted the spot. The disease was halted and the seeds grew to maturity. I dusted a bulb with benlate-rootone mixture, after it lost its root system through my faulty watering habits and the bulb began growing again. In 1975, I decided to try and grow Tall Bearded Irises, which normally do not grow in Florida. I am using the benlate solution on them and am obtaining good results.

Through routine buying, I purchased a Dutch Hybrid *Amaryllis* which blooms in February and repeats in June. That following February after my purchase, the first scape was blown away from the plant during a thunderstorm. The bulb was planted under a tree and the scape was tied to a stake. The *Amaryllis* failed to bloom that February but bloomed instead in June. I thought this to be unusual, but assumed that the bulb would be back on schedule the next year. Instead, for five consecutive years, the bulb *bloomed both in February* and *in June*. There are two scapes in February and in June there is usually one scape, except one summer, there were two. The Amaryllis has also produced one bulblet which reblooms. My daughter says that perhaps lightening struck the bulb and resulted in a mutation, which causes it to rebloom. Is an *Amaryllis* which blooms twice a year a natural rebloomer or mutation? I have crossed the bulb with many other named Dutch Hybrids, back crossed and selfed. Not yet being able to determine whether any of the crosses that I have made will be rebloomers (the bulb must reach maturity before it reblooms), I have made preparation for the task of cuttage by cutting several bulbs.

I did study botany in high school and college, but had forgotten so much. With the help of Dr. Bell, Mr. Doran and Dr. Whitaker, I was able to perform the above experiments. I wish to thank Mr. Doran and Dr. Bell for the plants and many seeds they sent to me.

SHIELDS—**HYMENOCALLIS CULTURE**—continued from page 80.

If so, they are both probably from the same clone; and perhaps this is a case of either self-sterility or of a sterile clone. Accordingly, anyone who would be willing to provide bulbs of *H. amancaes* clones known to be of wild origin, or to provide pollen of such clones in season, is urged to contact the author. Is it really necessary that a beautiful flower like *H. amancaes* remain so rare in our gardens?

4. AMARYLLID CULTURE

[ECOLOGY, REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

MEET THE AMARYLLIS

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During my High School years I became interested in Horticulture and promptly decided that some phase of plant culture would be my life work. From my home in South Pasadena I would take trips around Southern California to visit nurseries and flower farms that I had learned about from magazine and news reports. On one of these trips in 1922 I was deeply impressed by the beauty of a 4 acre field of *Amaryllis* in full bloom in Montebello, grown by the Howard & Smith Nurseries. That was the beginning of a life long love for what I considered to be the "King of Flowers."

In my early years I was employed in the flower seed and bulb department of a large Los Angeles seed firm, and later as a plant breeder for a large canning company. Then followed 43 years in my own seed and farm supply business during which time I always had some *Amaryllis* among my seed fields.

In the 1950's I became interested in photography as a hobby and built several motion picture processing machines during the following years. As my love for *Amaryllis* became rekindled it was only natural that the two hobbies of *Amaryllis* growing and collecting and motion pictures should be wedded into a burning urge to make a film about the subject of *Amaryllis*.

In 1968 I undertook the production of a film that has turned out to be the most popular one that I ever produced. "Waltz of the Flowers" illustrated through time lapse photography the rhythm of plant growth and matched the movements of plants and flowers to the rhythm of the waltz and ballet. It has been shown to Garden clubs, schools, nature groups, service clubs and others for years and receives an eager response wherever shown.

Since movie makers are always on the prowl for good subject matter, the success of "Waltz of the Flowers" turned my thoughts to the making of a film about the *Amaryllis* family of plants and so I started in earnest to collect specimens suitable for time lapse photography. Plants for this work must be grown in pots and since many Amaryllids bloom well when pot bound it was not too difficult to get subject material. When ready to bloom the potted plants are brought into the dark room where completely controlled light conditions can be maintained day and night continuously for weeks at a time. When making "Waltz of the Flowers" I learned that many plants simply will not bloom under photographic light conditions. Gloxinias, purple Wandering Jew, and

squash were notable in this regard. During the many years that I grew Zucchini squash for seed I was always impressed by the delicate beauty of the Zucchini flowers in the light of the early sunrise. In a matter of a few hours this beauty faded and withered away in the heat of the morning sun.

I thought I might capture this show in time lapse, so I grew some Zucchini plants in 5 gallon tubs. When they started to bloom I brought them into the dark room and set the camera and lamps to record the blooming process. But as soon as the photo lamps came on, for only 8 seconds out of each 6 minutes interval, the flowers shriveled and curled and died.

Fig. 20. **Belex Rex 4 Camera** with wide angle lens and **Stevens Interval Timer** set to take a picture every 6 minutes to study growth of **Heamanthus coccineus.** Camera with Stevens Interval Timer can be used to film plant on an electrically operated **turn table** to view all angles of plant as it **grows**, flowers and sets fruits containing seeds.

Amaryllids seem to enjoy the light of photo lamps, and I have not had trouble with the natural blooming of any specimens under these conditions. Many interesting features of plant growth can be closely watched on the screen since most plants grow so slowly that their changing development can not be given comparative observation day and night. Under time lapse the growth time is speeded up damatically. My Stevens Interval Timer (Fig. 20) is always set to take one 16 mm frame or picture every 6 minutes. When the same film is shown on the screen it runs through the projector at the speed of 24 frames per second. This action compresses 24 hours of plant growth into 10 seconds and gives graceful movements to flower opening. Many unexpected movements occur as in the proud gestures of day lilies and the ballet

like swell of *Iris* petals. A pot full of various colored Tigridias flowers opening, swelling and closing in unison is a breathtaking sight. The graceful flare of the *Hibiscus* as the petals wave in waltz time and the intermittent opening and closing of *Ranunculus* in perfect rhythm day and night, the gentle sway of Anemones nodding from side to side all add to the wonder and beauty of the plant world.

Music and plants seem in complete accord. Easter and other Trumpet lilies swell to the sweet strains of trombone soloist and band playing "Ave Maria". Godetias open and close like swirling ballet skirts to the tune of "Les Sylphides". *Billbergia* petals curl and recoil and *Amaryllis* pollen sacs split and reverse in harmony with a Chopin Etude. *Philodendron* leaves sway and shake open their tightly packed folds to the lilting tunes of the waltz.

Presently I am working on "Meet the Amaryllids", in which all the actors are specimen potted plants of the *Amaryllis* family. Beset by seemingly endless failures—wrong exposures, flowers that grow out of the expected picture area, lamps that burn out during the photography of an irreplaceable specimen, wrong filters or errors in lighting color, or lamps that fade in color during a run, all make time lapse films many times more difficult than straight camera run motion pictures.

The difficulty in acquiring specimens and the lack of communication between those who grow *Amaryllis* for sale are also serious drawbacks. Another problem for me has been in getting potted specimens to bloom at all. I still need better pictures of Nerines, *Agapanthus, Crinums, Galanthus, Griffinia, Haemanthus, Hymenocallis, Ismene, Ixiolerion, Leucocoryne, Leucojum, Pancratium, Pyriolirion, Vollata* and *Worsleya.* Many of these above named are in my collection but have not bloomed, others, such as *Worsleya* and *Vollata* rot soon after I plant them, and for many others I have not found a source of supply. The high cost of specimens is certainly a deterrent to increasing my collection, but I buy them as funds are available if and when I can find them. I would appreciate receiving catalogs and price lists from any growers who have various Amaryllids for sale.

There are many faces on the cutting room floor of Amaryllid flowers that didn't pass inspection, but when the last trumpet blares to the opening of *Cyrtanthus lutescens* the garden clubs of Southern California will have a chance to view the results of an engrossing hobby.

1976 ZEPHYRANTHEAE REPORT

Mrs. Marcia Clint Wilson, *Chairperson, Zephyrantheae Committee, 255 Galveston Road, Brownsville, Texas 78521*

It is difficult to begin a report when my own collection of Zephyrantheae has performed so poorly. The last of my Galveston Rain Lilies were dug in February '76 while I was in town to move my furniture. All of the labels that had been buried in the ground with just the tip showing were in good shape. They had been marked with a plastic label maker and a soft lead pencil. The charts I had kept on all bulbs

planted in the ground were a great help in identifying the few bulbs with missing labels. I did have one upsetting experience for which there is little help. Before the soil was settled in one box of one-of-a-kind hybrid bulbs, a dog dug from one end of the narrow area to the other. I now have a large garden plot that is fenced from rabbits and dogs, but hesitate to use it for bulbs until my schedule permits regular weed control.

For those of you who are looking for inexpensive containers, visit a busy aquarium shop. Tropical fish are usually shipped in styrofoam boxes that are ideal for growing a number of small bulbs. The ones I found measured 16″ x 16″ and were sold for fifty cents each. Thad Howard has had great luck with these and he uses the lids for cold protection. His initial experience with aquatic plants has been equally good. He makes no drain holes and keeps about an inch of water above soil level.

John D. Fellers of Mobile, Alabama is collecting and studying the numerous forms of *Z. atamasco* from different localities. His hybridizing work is well underway with a 1967 X Sydneya (*Z. atamasco* x *H. robustus*) and various other crosses using special forms of *Z. atamasco*. A 1971 *Z. atamasco* x *zephyranthes* sp. gave him four scapes from one bulb that were most interesting. The flowers were somewhat *Habranthus*-like with some nodding or trumpet shape and anthers which appeared to have a 3/3 configuration. Hybridization is an important tool in studying relationships among species and between closely related genera. *Zephyranthes albiella* has flowers that are slightly nodding and filaments of several lengths and I am sure that there are more *Zephyranthes* species that share one or more *Habranthus* characteristics. The late Alex Korsakoff used another eastern U. S. native, *Z. simpsonii* as both seed and pollen parent. A bulb of his *Z. clintiae x Z. simpsonii* bloomed for the first time and it was an astonishingly beautiful peppermint stripe of dark rose and rose red. The rather large flower was normal in all respects; so I'm hoping that the pronounced two-toned effect is permanent. The bulb that bloomed was quite large. Is it going to take a forced rest period to bloom some things?

CRINUM SEEDS AND BULBS NEEDED FOR CANCER STUDY

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The National Cancer Institute is urgently in need of 3000 or more *Crinum* plants (bulbs). The type specified is 'Milk and Wine' but since this name is so vague and applies to *C.* x *herbertii*, *C. zeylanicum* hybrids and other forms common to Florida and the Gulf we are uncertain as to what form is desired or if this makes much difference.

For many years it has been known through tropical Africa that *Crinum* juices were particularly effective in curing tropical sores. In fact the Portuguese explorers learned this when they started exploiting

the African Gold Coast back in the early Sixteenth century. When placer gold was found near Sao Paula and Rio Janeiro toward the end of the sixteenth century Gold Coast negroes were taken to Brasil to work these placer deposits. Their local food and medicinal plants were also taken to Brasil and this included *C. jagus* (Syn *C. giganteum*) where it became an escape. The same plant was also taken to Goa, India and into the Malay area as well as the Philippines due to its curative values. As a consequence several variants are scattered widely through the tropics.

Similarly, *Amaryllis evansiae* has been found to have tumor inhibiting properties. Possibly Beltsville, Md. can give us more information on their discoveries. All in all it is particularly interesting that the medicinal benefits of the Amaryllidaceae have been recognized and it is possible that the entire group may be subjected to extensive research.

POT CULTURE OF **AMARYLLIS AGLAIAE**

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In a personal communication, Leonard Doran noted that *Amaryllis aglaiae* tends to set its bulb deeply in the ground and therefore is difficult to grow well in conventional pots. Mr. Doran had cleverly used a length of clay drain tile as a pot in his glass house to produce satisfactory bloom on this species. In ordinary pots, the bulbs would pull themselves to the bottom and produce offsets instead of blooms.

It seemed that *A. aglaiae* needed to be planted very deep to bloom well, but I conceived another possible explanation of the observed behavior. Perhaps. I reasoned, the bulb of the species did imbed itself deeply, but perhaps the poor bloom in pots was caused by something else. Maybe a bulb growing at the bottom of a pot simply did not have enough room underneath for good root growth.

To test my idea, I placed enough growing medium in a plastic one-gallon nursery can to leave about 2-5 inches of space at the top. Then I cut a disc of 3/8-inch galvanized hardware cloth (wire mesh) and laid it on top of the soil. Next, six *A. aglaiae* seedlings were planted on top of the wire mesh in more soil, with irrigation space at the top.

In less than two years, the plants bloomed very well indeed, and the bulbs were still near the surface of the soil. They could not dig themselves through the strong metal mesh, but their roots were not impeded. Now, another season later, the bulbs are still barely covered, and they are quite large and healthy.

Several other *Amaryllis* species, as well as other amaryllids, have the undesirable tendency of growing at the very bottom of pots. I hope that other growers will test the technique described above on some of these stubborn deep-diggers. A few candidates that come to mind are *A. reticulata, A. parodii*, and some of the rain lilies, as well as *Hymenocallis*.

I have observed, however, that a long neck on a species does not *necessarily* indicate that it wants to grow far below the soil surface.

For instance, *A. pardina*, *Amaryllis calyptrata*, *Worsleya rayneri* (the Blue Amaryllis), and similar species seem content to stay at the surface, even though some have fine long necks.

HYMENOCALLIS CULTURE IN INDIANA

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For the past several years, a number *Hymenocallis* species have been grown with some success in central Indiana. Two methods have been used, depending on the requirements of the particular species. The first type to be tried was the ubiquitous commercial variety 'Festalis', and it was grown by the so-called "gladiolus culture" method. That is, the bulbs are planted in late spring or early summer and dug in early fall, to be stored bare through the winter in open boxes at 55° ± 5°F. Under this method, 'Festalis' has increased so rapidly that many smaller offsets are discarded annually due to lack of garden space and lack of takers among the author's circle of gardening friends.

This same cultural technique has been found to work well for *H. amances*, 'Helios', *H. longipetala*, and 'Pax' The species *H. acutifolia*, *H. eucharidifolia*, *H. glauca* (Zucc.) Roem., *H. horsmanii*, *H. littoralis*, *H. occidentalis*, and *H. riparia* have done less well when grown in the above manner. For some of the these, a second method has proved somewhat better, as described below. For a few, such as *H. horsmanii*, *H. littoralis*, and *H. riparia*, no method is totally satisfactory here.

The evergreen forms *H. caribaea* and 'Tropical Giant' are grown the year round in pots, with very infrequent repotting. The plants are grown in full sun from late spring till cool weather returns in autumn. They are then stored at about 50-60°F at west windows. Relatively little water is given during storage. The older leaves gradually turn yellow and dry out, but these two forms invariably retain some live foliage throughout the entire period of dormancy.

Several of the previously noted deciduous species seem to do best if grown in pots year round. They do not, of course, require light during storage. This group includes *H. acutifolia*, *H. azteciana*, *H. eucharidifolia*, and *H. glauca*. The last three species are, however, repotted every year or two. *Hymenocallis acutifolia* have not been disturbed in their pots for several years now. A few seedlings of *H. acutifolia* are handled by the "gladiolus" method, due to space limitations, and they are not so vigorous as their constantly potted siblings.

Seedlings of the collection No. 74-40 (Bauml, tentatively identified as *H. latifolia*) did less well kept in pots than those stored bare. These plants are still too small to bloom, so definitive conclusions on their culture in this area must wait.

The bulbs of *H. graminifolia* are so small that they are grown in pots in spite of the fact that it appears as if they might prefer "gladiolus" culture. They could too easily be overlooked in the haste

of the fall digging season. The species *H. liriosme* is kept potted, but unlike the others, it is never allowed to remain completely dry for any extended periods. The pots are kept in plastic buckets during the growing season, and some water is usually kept standing in the buckets. Results are equivocal—one successful scape in 1975, none in 1976. Advice from other growers of *Hymenocallis liriosme* is earnestly solicited.

FERTILITY

Very few types of *Hymenocallis* have set seed reliably as grown here. Only *H. acutifolia* and *H. eucharidifolia* do so regularly. The small species *H. horsmanii* did so just once, and that was fortunate. The mother bulb subsequently died, and only those seedlings survive to represent *H. horsmanii* in the author's collection. They are still quite small, and are kept continuously potted. The species *H. acutifolia* appears to be apomictic. Usually, seed are set without the intervention of the author; but on one occasion, a pot of *H. acutifolia* bearing a new scape was brought indoors. As the florets opened, they were pollinated with fresh pollen collected from 'Festalis Zwanenburg' growing in the garden. Two seeds were obtained, and these two both yielded plants which appear indistinguishable from the pod parent.

Attempts to set seed on *H. amancaes*, 'HELIOS', 'FESTALIS', *H. caribaea, H. longipetala*, 'PAX', and 'TROPICAL GIANT' have been uniformly unsuccessful. Here, too, the author would be grateful for suggestions from growers who have achieved successful hybridizations with *Hymenocallis.*

NEW DIRECTIONS

Following the suggestions of various persons recommending that one should attempt to utilize the late Len Woelfle's method of leaving *Hymenocallis* bulbs permanently planted outdoors (next to the foundation on the southern exposure of his house in Cincinnati), a few bulbs of 'Festalis' were planted next to a permanent clump of *Tigridia,* close to the southeast foundation of the house. These plants bloomed after two winters in the ground! The last two surviving bulbs of *H. occidentalis* were therefore planted nearby. Their foliage came up late in the summer, and was still green in mid-November after several days of 20-degree weather. The adjacent leaves of 'Festalis' were already dead. Just to be extra safe, the ground there has been mulched with oak leaves. Perhaps the *H. occidentalis* will survive here too.

The rather delicate species *H. amancaes* thrives here on "gladiolus" culture. The bulbs are plump and getting bigger, and they bloom reliably each summer. So far, however, they have shown no tendency to produce any offsets. These plants were obtained from a well-known dealer in rare bulbs, and may have originated in Holland, by cuttage.

SHIELDS—**HYMENOCALLIS CULTURE**—continued on page 73.

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POLIANTHES X BLISSII WORSLEY

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Mr. Luther Bundrant, of Texas, recently repeated this cross which from information received from Mrs. Susan Verhoek Williams was first made by the late Arthington Worsley (J. Roy. Hort. Soc. *36*: 603-605). It is a hybrid between *Polianthes geminiflora* x *P. tuberosa.*

This hybrid is essentially intermediate between its parents, having the delicious fragrance of *P. tuberosa* combined with the rich rose pink color of *P. geminiflora* (Bravoa geminiflora). The hybrid has been made on still another occasion. Richard E. Harrison in his book A HANDBOOK OF BULBS AND PERENNIALS FOR THE SOUTHERN HEMISPHERE, written for New Zealand and Australia spoke of such

Fig. 21. **Polianthes x blissii** Worsley, a cross between **P. geminiflora** ♀ and **P. tuberosa** ♂. Reproduced from color photo.

hybrids having once existed when he said "Hybrids have been raised with the tuberose (and Bravoa), but these seem lost to cultivation" (1963). Some coloured forms of the popular scented tuberose would be a great asset; Perhaps someone will again attempt to cross them again in this country (New Zealand).

The writer once discussed this possible hybrid with Luther Bundrant, and he was enthusiastic to begin such a project as he especially favored the scent of tuberoses. Supplied with living material of P. geminiflora, he embraked on a large program of hybridizing various new *Polianthes* species with the tuberose and with one another. The main objective was to create colored flowers having the tuberose fragrance.

In only two years he has flowered the first of these hybrids. There are many new seedling combinations now growing and soon we may be flooded with a myriad of new *Polianthes* hybrids. *Polianthes tuberosa* not only crosses freely with other *Polianthes*, but also with *Manfreda* and *Prochnyanthes*. Mrs. Susan Verhoek Williams, currently monographing *Polianthes* and *Manfreda*, has flowered a cross between *Manfreda virginica* x *P. tuberosa*. The hybrids are said to be fragrant, but with greenish flowers. The plants previously known as the genus *Brovoa* have been united with the *Polianthes* section, and this seems logical and is supported by the finding of much new material in recent years.

History of Luther Bundrant cross:

Summer 1974—pollenation program begun. Polianthes tuberosa was attempted on all flowers (10 scapes), of *P. geminiflora*. A total of six seed pods were obtained, one was insect damaged. Three pods on one scape, two pods on another, one pod on the third. 25 Aug. 1974—Thirteen seeds were planted from two pods of one scape. Seeds began germination in ten days. 23 Sept. 1974—ten seeds have germinated, all of which bulbs still survive (1976). 2 Oct. 1974—39 seeds planted, 22 bulbs surviving (1976). (described flower from this group).

1976—Total of 32 bulbs in growth. 4 Aug. 1976—First scape identifiable at about 15cm height. 25 Aug. 1976—First flower opened. 31 Aug. 1976—Second scape in group emerged from crown. 9 Sept. 1976—Last (26th) flower opened.

An equal number of the reverse cross were attempted with no success.

Polianthes × Blissii Worsley

J. Roy. Hort. Soc. 36: 603-605.

DESCRIPTION.—Flower began opening at 5:00 o'clock p.m. CST 25 August 1976. Paired, tilt upward at 30 - 45 degrees from horizontal. Lower half of tube curved on a 2.5 cm to 3.8 cm radius, upper half straight. Tube 2.8 cm long. Tepals 0.6 cm long uniting to form a tube. Ovary 0.6 cm long. Pedicel 1.2 cm long. Flare of tepals 1.1 cm to 3.8 cm.

Flowers are uniformly colored dark pink (reddish pink) throughout with very fine ivory stippling, slightly glaucesent exterior, interior is pinkish ivory. Another closely clustered together at top of tube interior extending to tepal end of tube. Pollen bright yellow. Fragrance is like P. tuberosa but slightly less intense.

Floral bracts one per pair of flowers, 0.3 cm at base tapering 0.6 cm to 1.2 cm to acute point. Base colored pink to white, tip green.

Scape 1.2 m long, flowers paired radially with second set (buds) 8.9 cm above first flowers. Scape from crown to first flowers 0.9 m. Total of 27 flowers and buds.

Thirteen leaves in rosette, 1.1 cm to 1.7 cm wide and 45 cm to 55.5 cm long, the more narrow leaves being longer and younger. All leaves channelled, but the younger leaves channelled more deeply than the older ones. Moderately dark dull green. The typical leaf tapers from

midway (widest point) to an acute point. Leaves semi-erect, stippled reddish to reddish-brown on lower surface to 1/3 their length, upper surface of this individual is not stippled.

SPECIMEN: *Polianthes x blissii* Worsley, No. 1133 (TRA)

PLANT LIFE LIBRARY—continued from page 30.

American Edition, and a General Preface. The main body of the book is in two parts. **Part I** is devoted to the design and running of greenhouses, giving complete details from site selection to vegetative propagation. **Part II** is concerned with the growing of plants in greenhouses, including vegetables, ornamentals, cacti, ferns, and alpines; and control of plant pests and disorders. An appendix and index complete the volume. Highly recommended to all greenhouse gardeners.

SMALL FRUIT AND VEGETABLE GARDEN, by Jacqueline Heriteau. Sterling Publ. Co., 419 Park Av. So. New York, N. Y. 10016. 1975. Pp. 192. Illus. Trade Edition $4.95. The author recommends not to "overlook any space, no matter how unlikely for starting a garden." The book is in four parts. **Part I** deals with little gardens for food, the space required, climbers, hanging baskets, miniature vegetable and fruit gardens, and planting plans. **Part II** is devoted to soils, watering, weeding, mulching and tools. **Part III** is in the nature of a dictionary of food plants for early, mid and late spring; herbs in small places and orchard and bramble fruits. **Part IV** concerns the matter of keeping the garden healthy. Recommended to those who must do with small garden spaces.

STARTING FROM SCRATCH: A GUIDE TO INDOOR GARDENING, by John Whitman and Mary Mcguire. Quadrangle/New York Times Book Co., 10 E. 53rd St., New York, N. Y. 10022. 1976. Pp. ix + 211. $8.95. This book has been written for the beginning gardener. The first part of the text is devoted to plants easiest to grow (Chapter 1); plants somewhat more difficult to grow (Chapters 2 and 3), and plants such as bananas, lychees, etc., exotics, delicate plants that demand patience and skill to maintain (Chapter 4). The final part is concerned with basic questions about successful gardening (Chapter 5). Recommended to beginning gardeners.

FOREST AND GARDEN, by William H. White, Jr. Sterling Publ. Co., 419 Park Av. So., New York, N. Y. 10016. 1976. Pp. 96. Illus. Trade Edition, $4.95. This fascinating little book describes "the natural processes that create and maintain the forest, and the artificial techniques by which man creates and maintains the garden. He examines the typical life forms to be found in each habitat. The book is in five sections—**The Forest**, the plants and animals; succession; life cycle of the forest. **The Garden,** annuals and perennials; recycling animal matter, and fertilizers. **THE FOREST GARDEN INTERFACE.** Dwellers in the interface; interface flora. **SOME ANIMAL COMMUNITIES,** earthworms, molluscs, insects, arachnids and vertebrates. A brief section on **CONCLUSIONS,** and an index complete the volume. Highly recommended.

AN EARTHWORM IS BORN, by William White, Jr. Sterling Publ. Co., 419 Park Av. So., New York, N. Y. 10016. 1975. Pp. 80. Illus. $4.50. This fascinating little book describes the life cycle of the earthworm, its habitat, reproduction and life span; its anatomy, nervous and digestive, and circulatory systems; its ecology; and function in aerating the soil; the ingestion and digestion of decaying vegetative matter (humification); earthworm castings which are a factor in humus formation; method of observing earthworms, and raising earthworms. Everyone should be required to read this mighty little book to learn about the beneficent role the earthworm plays in the economy of nature. Highly recommended.

LYSINE SYNTHESIS PATHS AND THE BIOEVOLUTIONARY COURSE

HAMILTON P. TRAUB

Abstract. (1) The available data on lysine synthesis paths DAP and AAA corroborate the Traub 1964 grouping of higher phylons of cellular organisms (cellular biology), requiring only a minimum of revision in details. (2) The untenable nature of the "Kingdom Protista or Protoctista" concept is revealed. (3) The segregation of the archi-, and meso-period eucaryotic heterotrophs (parasites and saprobes) of Subkingdom 1. *Plantae* under Subkingdom 2. *Mycotae* is no longer tenable since neo-period heterotrophs, *Cuscuta* (Dodder), etc., were formerly retained under *Plantae*, and archi-, or meso-period heterotrophs, Phylum *Hydotophyta*, are now recognized under *Plantae*, and the phototrophic Phylum *Euglenmycota*, has been placed under *Mycotae*. Other conclusions are included at the end of the paper.

TABLE OF CONTENTS

I. INTRODUCTION

This paper *(1)* is gratefully dedicated to the authors of the following cited papers,—R. Y. Stanier and J. S. Van Niel *(2)*, R. Y. Stanier, M. Doudroff and E. A. Adelberg *(3)*, H. J. Vogel, J. S. Thompson and G. D. Shockman *(4)* and R. Y. Stanier *(5)*, whose scientific publications inspired the writer.

With still some *mediaeval* thinking about the subject of linoclassification (grouping) of living things on earth in the scientific journals, it is considered a duty to speak out for a return to the reality of science in the field of *lineagics.*

Due to space limitations, the following historical review is not exhaustive, and emphasizes some high lights. By the end of the 19th and the beginning of the 20th centuries, the grouping of organisms had reached a standardization of sorts as shown in Grouping No. 1.

GROUPING NO. 1

Kingdom 1. **Plantae.** According to the Bergen & Davis 1906 outline **(6)**
- Division 1. Thallophyta: algae, including the Blue Green Algae, Fungi and Bacteria.
- Division 2. Bryophyta
- Division 3. Pteridophyta (ferns)
- Division 4. Spermophyta (gymnosperms and angiosperms)

Kingdom 2. **Animalia.** According to the Thomson 1895 outline **(7)**
- Subkingdom 1. Protozoae
- Subkingdom 2. Metazoae

The workers with Kingdom *Plantae* (botanists) were often not on

* Numbers in parentheses refer to references and notes at the end of the articles.

speaking terms with those working in the field of *Animalia* (zoologists) and *vice versa*, and each was fighting to obtain exclusive right to deal with borderline groups. The zoologists had done a better job in grouping *Animalia* and the main groups were mostly established. The botanists were quite hazy about placing certain groups under *Plantae*, which included also *Fungi*, *Bacteria* and *Blue Green Algae*.

It had been known for a long time that there were two kinds of cellular organization—the *procaryotic* and *eucaryotic* types. However, the great significance of these facts was not realized and inaccurate grouping of organisms in part persisted.

Since the 1880's, attempts had been made to find out how the nucleated cell originated from the non-nucleated cell: in 1882, Schimper (*8*); 1890, Altmann (*9*); 1905, 1910, 1920, Meschkowsky, (*10, 11, 12*); 1907, Famintzen (*13*); 1927, Wallin (*14*); 1961, Ris (*15*); 1962, Ris & Plaut (*16*); 1963, Nass, M. & S. Nass (*17*); and 1963 Nass, S. & M. Nass *(18)*. With none of these workers did this search become an obsession.

In 1937, Chatton (*19*) characterized the *procaryotic* and *eucaryotic* patterns of cellular organization. In 1956, Copeland (*20*) recognized *Procaryotae* under the term *Monera*. In 1957, Simpson et al, (*21*) adopted a three kingdom system—1. *Protista*, 2. *Plantae* and 3. *Animalia*. Their Kingdom Protista includes bacteria, flagellates, rhizopods, *Plasmodium, Ciliophera* (classes—Ciliata and Suctoria) and *Myxomycetes* (slime molds). The Blue Green Algae were placed under Kingdom *Plantae*.

In 1960, Cronquist (*22*) earned the distinction of placing the bacteria and Blue Green Algae at last in a single separate division under *Plantae*.

In 1962, Stanier and Van Niel (*2*) clarified the concept of the bacterium; in 1963, Stanier, Doudroff and Adelberg (*3*) published the stimulating second edition of *The Microbial World*, and suddenly the skies cleared with a full realization of the importance of the two cell types—procaryotes and eucaryotes.

In 1964, Traub *(23)* at last was able to envision the broad outlines of *earthbiology* as a whole, no longer in bondage to the mediaeval past, an ideal which he had been seeking for over a half century.

II. THE 1964 EARTHBIOLOGY HYPOTHESIS

Among the first attempts to bring the new outlook to bear in reconsidering the major phylons of living things on earth was that of Traub (*24, 23*) in 1963 and 1964. The solution would have to account for all living things on planet earth for the old fragmented method of presentation had stunted the outlook of the student in the primary, grammar and high school levels of education. Some students were exposed to only botany (an obsolete name for a confused outlook). At-

tempts to correct this condition spawned the movement toward presenting only texts in elementary biology below the college level, which was all to the good. This trend will have to be encouraged by presenting the whole overview of the science of *earthbiology*, so named to distinguish it from possible *exobiologies* treating of life on other planets in the universe. It would be declared a cardinal sin to fragment *earthbiology* below the college level.

As indicated (Traub, *23*, pp. 131, 140; *24*, *25*, *26*), earth organisms are either cellular or non-cellular on the primary level. Thus, there is the science of *Cellular Biology*, Superkingdom 1. *Cellularae*, contrasted with non-cellular organisms, Superkingdom 2. *Acellularae*, the science of *Virology*, which is placed second because the viruses require the enzymatic mechanisms of cellular organisms for reproduction, and apparently they have evolved from cellular organelles.

Due to lack of space, the *Science of Virology* will not be explored because this is a task that the virologists are trying hard to complete. Further discussion here will be concerned only with the Science of *Cellular Biology* for there the dead hand of the mediaeval past still is active even in this atomic age.

THE LAW OF LINEAGIC RELATIVITY. The law of lineagic relativity (Traub, *23*, Fig. 4, pp. 87-88) describes what is axiomatic, and some may believe that it is un-necessary. However, when some workers ignore it, and confuse lineagic groups that existed in an earlier age with groups in the contemporary period, the value of that law is readily apparent as a valuable deterrent. The keystone in the arch of the science of *lineagics* is the *theory of bioevolution*, and one of the main supporting arch stones is the *law of lineagic relativity*. It is applicable to that phase of lineagies which makes it clear that the chronological (time) factor is correlated with bioevolutionary changes in organisms. Thus, the lineagic groups of an earlier period evolve (change advance or retrograde) with time (the factors are so many, and some unique, so that the odds against the same resulting lineagic product, from period to period, is overwhelming) and can never again be identical with later groups for the environmental conditions and the nature of the genes (nucleic acid) have changed from period to period. The law has other applications—the origin of heterotrophs, for instance.

It is due to the lack of awareness of the *law of lineagic relativity* that some workers confuse *relict* (used here to identify relatively undifferentiated organisms in the contemporary period) contemporary lineagic groups (*Chlorophyta, Euglenophyta, Sporozoa, Zoomastigina, Sarcodina, Ciliophora, etc.*) with their progenitors of an earlier time period, and come up with that mediaeval artifact, "Kingdom Protista". Such happenings can be explained as due to the unfortunate long history of *lineagics* as a discipline (*23*) which began with the early Greeks, muddled through the Middle Ages, was a discipline with emphasis on classification before the advent of the Darwinian theory of bioevolution, and is slowly surfacing as a modern science of *lineagics* based strictly on verifiable data and with the theory of bioevolution as its backbone. *Lineagics* could not start out with a clean slate in the early 20th century

like *genetics*, and still has to finally divest itself of the last vestiges of mediavelism.

THE 1964 EARTHBIOLOGY HYPOTHESIS. Constructed in 1964 (*23*), it is based on scientific facts with inferences about the bioevolutionary course and was to be tested against additional available experimental evidence.

For the present discussion, the postulated conditions under which life originated five or more billions years in the past (*23*), will not be considered. More than a million species of organisms with the cellular organization have been described, including those with the *procaryotic* and *eucaryotic* cellular structure *(23)*, and with many more remaining still to be discovered and described.

(a) Kingdom 1. *Procaryotae.* In this main lineage, there is the contemporary Subkingdom 1. *Procaryotae* with offshoots: Subkingdom 1. *Autobacae*, autotrophic lineages, including Infrakingdom 1. *Chemoautobacae*, and Infrakingdom 2. *Photoautobacae* (containing among other, the ex Blue Green Algae); and Subkingdom 2. *Heterobacae* (bacteria) which apparently have originated from the former kingdoms (see Grouping No. 2).

The first phototrophic *eucaryotic* cell apparently originated from some *Photoautobacae* ancestor, as evidenced by the presence of *chlorophyll* in ancestor and offspring. The difference in cellular organization is sufficient to warrant recognizing a separate kingdom—Kingdom 2. *Eucaryotae*.

(b) *Kingdom 2. Eucaryotae.* The original eucaryotic cell apparently had pontentialities for evolution in the direction of plant-like features, giving rise to subkingdom 1. *Plantae* under Kingdom 2. *Eucaryotae* (see Grouping No. 2).

The heterotrophs that developed from the main *Plantae* lineage during the meso-period developed into Subkingdom 2. *Heteroplantae* or fungi.

However, early in its history in the archi-period, a mutant lineage with potentialities of evolving in the direction of animal-like features appeared as an offshoot from the *Plantae* main lineage. This very soon branched out becoming ever more animal-like and produced Subkingdom 3. *Animalia*.

This hypothesis is summarized in Grouping No. 2.

GROUPING NO. 2. THE 1964 EARTHBIOLOGY HYPOTHESIS
(23, 24, 25, 26)

Superkingdom 1. **CELLULARAE** (CELLULAR BIOLOGY)
Kingdom 1. **PROCARYOTAE**—organisms with the procaryotic cellular organization.
Subkingdom 1. **AUTOBACAE** *—obligate or facultative procaryotes and related neoheterotrophs
Infrakingdom 1. **CHEMOAUTOBACAE**—obligate or facultative chemoautotropha, and related neoheterotrophs
Infrakingdom 2. **PHOTOAUTOBACAE**—obligate and facultative photoautotrophs, and related neoheterotrophs

* Out of respect and gratitude to the outstanding bacteriologists who demonstrated in detail the nature and difference between the procaryotic and eucaryotic cell structure, the suffix—bacae has been adopted for the groups in the subkingdom through the class levels (see 23) so that future workers will know and honor the pioneers.

Subkingdom 2. **HETEROBACAE**, archi- and meso-heterotrophic procaryotes (Bacteria)
Kingdom 2. **EUCARYOTAE**—organisms with the eucaryotic cellular organization
Subkingdom 1. **PLANTAE**—obligate or facultative photoautotrophic eucaryotes, and related neo-heterotrophs
Infrakingdom 1. **ENEMBRYOPHYTAE**—includes the algae
Infrakingdom 2. **EMBRYOPHYTAE**—includes bryophytes and tracheophytes or vascular plants
Subkingdom 2. **HETEROPLANTAE**—includes mesoheterotrophic eucaryotes or fungi
Subkingdom 3. **ANIMALIA**—includes archi-heterotrophic eucaryotes or animals?
SUPERKINGDOM 2. **ACELLULARAE**—(VIROLOGY)—consisting of the stuff of life—a nucleic acid (DNA or RNA) core enclosed by a protein coat, but lacking the capacity for independent self-replication; they reproduce only by requisitioning the enzymatic mechanisms of cellular organisms.

The 1969 report, in the journal SCIENCE, by Whittaker (*27*), concerned in part with the outmoded "Kingdom Protista" concept, was challenging in part to the Traub 1964 (*23*) *earthbiology hypothesis.* Whittaker had apparently not read *Lineagics* (*23*).

III. LYSINE SYNTHESIS PATHS AND THE BIOEVOLUTIONARY COURSE

Ever since 1964, the writer had been looking for a comprehensive set of data for use in *testing* the original *earthbiology hypothesis* (*23*), but without success until 1970, when he opened the pages of a book to the most stimulating article by Vogel, Thompson and Shockmen (*4*), and Eureka!—he had found it! This is a summary of very expensive research, using labeled radiocarbon tracers, begun by the senior author in 1953, and by one of the co-authors in 1963. The three authors applied their results in charting the bioevolutionary course in cellular biology on the basis of lysine synthesis paths DAP and AAA, which are to be explained later in the present paper.

The objective in this Section is to test the 1964 *earthbiology hypothesis* (*23*) on the basis of the Vogel et al (*4*) data concerning organisms with the DAP and AAA lysine synthesis paths.

AN OVERVIEW OF EARTHBIOLOGY IN ONE FIGURE. Too often in the past, the field of *lineagics* has been fragmented by too early specialization. It is hoped that by providing an overview of the whole field of *earthbiology,* this deficiency can be corrected.

In 1964, Traub (*23,* p. 140) had constructed a figure representing organisms on earth evolving in the time frame. Figure 1 of the present report represents an updated version retaining the time dimension and adding also the lysine synthesis paths DAP and AAA data from Vogel et al (*4*) as markers or tracers, which are to be discussed later.

Figure 1 represents an attempt to convey most economically a maximum package of information in the least possible space—an overview

of the entire field of *earthbiology* with which the student should *begin his search.*

Beginning at the top of Figure 1, it is to be noted that on the primary level, Superkingdom 1. *Cellularae,* the *Science of Cellular Biology,* is contrasted with Superkingdom 2. *Acellularae,* the *Science of Virology,* which latter science is not to be considered further here for lack of space, but it should never be out of the students' mind.

On the secondary level, under Superkingdom 1. *Cellularae* (Cellular Biology), two possible kingdoms are recognized for it would be irresponsible to make more since all have the cellular organization, one group having the *procaryotic* cellular structure, Kingdom 1. *Procaryotae,* the *Science of Procaryology,* and the other the *eucaryotic* cellular organization, Kingdom 2. *Eucaryotae*, the *Science of Eucaryology.* This should end the *free for all scramble* for three or more kingdoms proliferation.

Due to space limitations, the consideration of Kingdom 1. *Procaryotae* had to be considerably curtailed, ending with the subkingdom level, but a reference source of further information is given. Under Kingdom 2. *Eucaryotae,* consideration extends to the phylum level for Subkingdom 1. *Plantae*, the *Science of Phytology:* and Subkingdom 2. *Mycotae, the Science of Mycology,* but again for Subkingdom 3. *Animalia,* the *Science of Zoology,* for lack of space, consideration extends only to the infrakingdom level—*Protozoae* and *Metazoae,* with reference to a source of further information.

LYSINE SYNTHESIS PATHS DAP AND AAA AS TRACERS. Lysine is one of the so-called essential life sustaining amino acids. *Procaryotes,* and of the *eucaryotes*, plants *(Plantae)*, fungi *(Mycotae)* and among animals (*Animalia*), most *Protozoae* but not *Metazoae,* including *Homo sapiens,* can *synthesize* lysine, one of the 20 essential amino acids that sustain life.

Vogel et al (*4*) consider a case where different pathways lead to a metabolite, *lysine,* which is common to *procaryotes* and *eucaryotes* alike. Two different lysine paths are known, the key intermediate in one is *a-E-diaminopimelic acid,* (DAP), and in the other, *a-aminoadipic acid* (AAA). The reader will realize at once by a glance at Figure 1, that with these biologic tracers present in both *procaryotes* and *eucaryotes,* it will be possible to detect the evolutionary course, revealing relationships among cellular organisms (Cellular Biology)—Kingdom 1. *Procaryotae* (DAP) and Kingdom 2. *Eucaryotae* (DAP & AAA).

Kingdom 1. *Procaryotae* (DAP) and Subkingdom 1. *Plantae* (DAP) (in Kingdom 2. *Eucaryotae*) both have the DAP path, tying these two groups together.

Subkingdom 2. *Mycotae* or fungi (AAA) is tied to Subkingdom 1. Plantae (DAP) by the common bond of the presence of *chlorophyll* (Phylum *Englenmycota* in *Mycotae*).

It happens ideally in this case that path AAA occurs within Subkingdom 2. *Mycotae* (AAA) and Subkingdom 3. *Animalia* (AAA), tying these two subkingdoms together.

All three subkingdoms are bound together by the common bond of the *eucaryotic cellular organization* showing that they all belong to

Kingdom 2. *Eucaryotae.*

With this efficient tool of the lysine paths DAP and AAA, the 1964 earthbiology pypothesis will be tested in even greater detail in the following discussion in order to correct any discrepancies.

LINEAGES EVOLVING IN THE TIME FRAME. In Figure 1, the evolving lineages of cellular organisms are plotted against elapsed time; in a theoretical diagram not drawn to scale. The archi-, meso-, and neo-periods indicate periods in time, when phototrophs gave rise to heterotrophs. The time factor is also necessary to *banish forever* the slovenly habit of piling lineages upon lineages as is often the practice in presenting figures. Surely, the time dimension is of the essence and cannot be omitted in considering bioevolutionary events (history). In the next revision, an attempt will be made to draw the time dimensions *approximately* to scale.

Line D-D represents the contemparary period. Therefore all lineages below this line are extinct and in the field of Paleo-cellular-biology.

All slanting and vertical lines within the rectangular figure A-D-D-A, beginning with the point of origin of life, represent *an indefinite number of lineages* evolving in the time frame, the *bold lines* standing for the *main lines* of evolution, and the *lighter lines* for offshoots.

Above the endings of the evolutionary lines (line D-D), appear the names of the major contemporary phylons,—Subkingdom 1. *Chemoautobacae,* etc.

Under Kingdom 1. *Procaryotae,* it will be noted that dotted lines with arrows connect the evolving autotrophic lineages with the "artificial lineage" Subkingdom 3. *Heterobacae* (bacteria), indicating that the points of origin of the latter (heterotrophic lineages) are unknown.

The designated biologic tracers, DAP and AAA, indicate the lysine synthesis paths as already explained.

RESEARCH IN ARCHI-, MESO-, and NEO-PERIODS. Research about the evolution of organisms—paleo-cellular biology—the possible origin of life under simulated Archi-Period conditions; on the basis of the fossil record, and inferences drawn from the study of *relict* lineages surviving into the contemporary period, are to be encouraged but always with due caution as stipulated by Stanier (*5*), never to allow speculation to become an obsession.

The archi-period is mostly a question mark. No consideration is given here to the accumulation of non-biologic "organic" matter prior to the origin of life as a basis for nurturing the first life until enzymatic mechanisms for obtaining energy independently with the aid of chemicals or light had been gained. The question as to which originated first, *chemoautotrophs* or *photoautotrophs* has still to be answered. Some claim that the photoautotrophs came first. The question is asked again in Figure 1. Investigations to determine how the *eucaryotic* phototrophic cell originated from the *procaryotic* phototrophic cell, since 1882, have not revealed how this happened. Here again, we should heed the caution of Stanier (*5*) that in such investigations speculation may do some good, unless it becomes an obsession for such speculation is

usually partly in the field of metascience.

CORROBORATION OF THE 1964 EARTHBIOLOGY HYPOTHESIS. When the figure of organisms evolving in time by Traub (*23*, p. 140) is checked against the Vogel et al (*4*) data (see Figure 1), there is a good agreement, requiring a minimum of changes in details.

Part of the *Phycomycetes* (DAP), those which make anteriorly flagellated or biflagellated spores have the DAP path of lysine synthesis, and were formerly under Kingdom 2. *Mycotae*, now under the new name, Phylum *Hydotophyta* (Gr. *hydor*, water, *-otos*, mold-like, *-phyticos*, plants), Water Mold-like Plants, *Achlya bisexualis, Sapromyes elangatus, Sirolpidium zoophthorum, Pythium ultimum, Hydrochytrium catenoides, Saprolegniales, Leptomitales, Peronosporales and Hyphochytriales*, had to be transferred to Subkingdom 1. *Plantae* with the DAP lysine path.

Those *Phycomycetes* (AAA) which produce non-motile spores, or spores with a posterior flagellum use the AAA path and must remain in Subkingdom 2. *Mycotae* with the AAA lysine path: *Rhizophyletis rosea, Allomyces macrogynus, Monoblepharella laruei, Rhizopus stolonifer, Chridiales, Bastocladiales, Monoblepharidales* and *Mucorales.*

Turning to Subkingdom 1. *Plantae*, the Phylum *Euglenophyta* with the AAA lysine path, under a slightly changed name, Phylum *Euglenmycota*, has to be transferred to Subkingdom 2. *Mycotae* (AAA).

These are the main changes in details required by the application of the Vogel et al (*4*) data to the 1964 *earthbiology hypothesis*, which has been corroboroated in major part.

As a result of these changes, Subkingdom 1. *Plantae* (DAP) has gained the arch-, or meso-heterotrophic Phylum *Hydotophyta* (Water Mold-like Plants), giving the first insight into the nature of the earliest plants (see Figure 1).

The transfer of the phototrophic Phylum *Euglenmycota* (AAA) to Subkingdom 2. *Mycotae* (AAA) gives this subkingdom at last a mainstem lineage reaching back to its origin in the archi-period (see Figure 1).

In the past, phototrophs, organisms that *synthesized* carbohydrates by means of chlorophyll and light, the *photosynthesizing* organisms, were strictly segregated under Subkingdom 1. *Plantae*, with one exception. The heterotrophs (food absorbers) that originated in the neo-period, *Cuscuta*, (Dodder), etc., were quixotically retained in that Subkingdom also.

The rest of the food *absorbers*, or heterotrophs (parasites and saprobes) that originated under the archi-, or meso-periods, if any were to be found, were to be placed under subkingdom 2. *Mycotae* (Fungi).

This practice is no longer tenable since the arch-, or meso-heterotrophs (Phylum *Hydotophyta*, DAP), are now recognized in Subkingdom 1. *Plantae* (DAP), and archi-phototrophs, Phylum *Euglenmycota* (AAA) in Subkingdom 2. *Mycotae* (AAA). However, in Subkingdom 3. *Animalia*, all are food *ingestors* (archi-heterotrophs), with partial loss of the lysine path AAA in *Protozoae* and total loss of the AAA path

in *Metazoae.*

LYSINE SYNTHESIS PATHS DAP AND AAA AND THE BIOEVOLUTIONARY COURSE. Turning to Figure 1, it is now apparent that by means of the tracers, lysine paths DAP and AAA, it is possible to chart the bioevolutionary course of Superkingdom 1. *Cellularae,* cellular organisms—Kingdom 1. *Procaryotae* and Kingdom 2, *Eucaryotae,* tying them together.

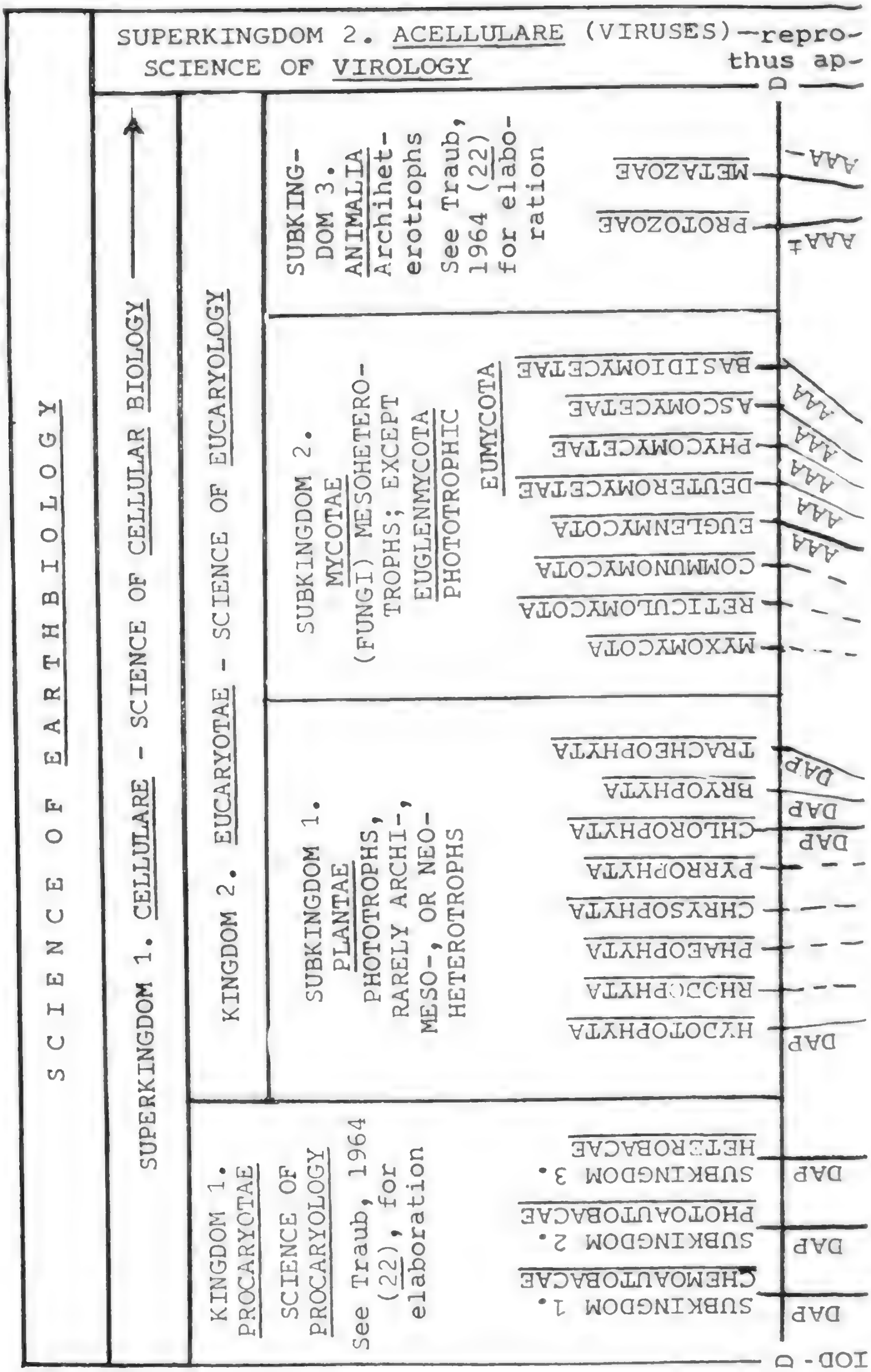
The more structurally primitive lineages, as indicated in Figure 1, originated early in the archi-period and developed the DAP path in two main stem lineages, Subkingdom 1. *Chemoautobacae* (DAP) and Subkingdom 2. *Photoautobacae* (DAP), and also the artificial Subkingdom 3. *Heterobacae* (bacteria) AAA, with roots in the two autotrophic lineages just mentioned.

Subkingdom 2. *Photoautobacae*(DAP), including also Phylum *Cyanobacae* (ex Blue Green Algae), with the *procaryotic* cellular structure, gave rise to the *eucaryotic* cell—the details as to how this happened we may never know. We infer that this did happen because phylum *Cyanobacae*(DAP) of Kingdom 1. *Procaryotae*(DAP), and the main stem lineage, Phylum *Chlorophyta* (DAP) of Subkingdom 1. *Plantae* (DAP), (of Kingdom 2. *Eucaryotae*) both synthesize lysine by the DAP path, and contain chlorophyll.

The main lineage, the *embryo* Phylum *Chlorophyta* (DAP), with inherent potentialities for evolving in the direction of plant-like characteristics, evolved into the future Subkingdom 1. *Plantae*(DAP), with spectactular success, becoming ever more plant like, eventually giving rise to the very successful offshoot, Phylum *Tracheophyta*(DAP), providing for *Homo sapiens,* trees for building, herbs for food and medicine, and the beauty of the rose to edify his soul, but that is another story.

An an early stage (see Figure 1) in the evolution of the Subkingdom 1. *Plantae*(DAP) lineage, a mutant *phototrophic* lineage originated with potentialities for evolving in a pattern intermediate between plants and animals. This lineage lost the DAP path irreversibly according to the Vogel et al (*4*) hypothesis (see Figure 1). After a time, this phototrophic lineage regained the capacity for lysine synthesis but by the AAA path according to the Vogel et al *(4)* theory, and soon gave rise to an offshoot which maintained the potentialities for evolving into organisms intermediate between plants and animals. It eventually gave rise to the contemporary phototrophic Phylum *Euglenmycota*(AAA), but all of its AAA offshoots during the meso-period lost the phototrophic capacity and together these represent Kingdom 2. *Mycotae*(AAA) of Kingdom 2. *Eucaryotae* (see Figure 1).

The original AAA lineage with potentialities for evolution in the direction of animal-like characteristics—food ingestion, in the archi-period, gave rise to the protists that led to the main *Protozoae*(AAA) lineage (see Figure 1). In the meso-period this lineage became ever more animal-like and before reaching the contemporary period, some groups lost the AAA path. A major offshoot, the *Metazoae* lost the AAA


SUPERKINGDOM 2. ACELLULARE (VIRUSES)—repro-
SCIENCE OF VIROLOGY
thus ap-
SCIENCE OF EARTHBIOLOGY
SUPERKINGDOM 1. CELLULARE - SCIENCE OF CELLULAR BIOLOGY
KINGDOM 2. EUCARYOTAE - SCIENCE OF EUCARYOLOGY
SUBKINGDOM 3. ANIMALIA Archiheterotrophs See Traub, 1964 (22) for elaboration
METAZOAE
PROTOZOAE
SUBKINGDOM 2. MYCOTAE (FUNGI) MESOHETEROTROPHS; EXCEPT EUGLENMYCOTA PHOTOTROPHIC
EUMYCOTA
BASIDIOMYCETAE
ASCOMYCETAE
PHYCOMYCETAE
DEUTEROMYCETAE
EUGLENMYCOTA
COMMUNOMYCOTA
RETICULOMYCOTA
MYXOMYCOTA
SUBKINGDOM 1. PLANTAE PHOTOTROPHS, RARELY ARCHI-, MESO-, OR NEO-HETEROTROPHS
TRACHEOPHYTA
BRYOPHYTA
CHLOROPHYTA
PYRROPHYTA
CHRYSOPHYTA
PHAEOPHYTA
RHODOPHYTA
HYDOTOPHYTA
KINGDOM 1. PROCARYOTAE
SCIENCE OF PROCARYOLOGY
See Traub, 1964 (22), for elaboration
SUBKINGDOM 3. HETEROBACAE
SUBKINGDOM 2. PHOTOAUTOBACAE
SUBKINGDOM 1. CHEMOAUTOBACAE
AAA
DAP
D
IOD - D

duce only by using cellular enzymatic mechanisms;
parently derived from cellular organelles.

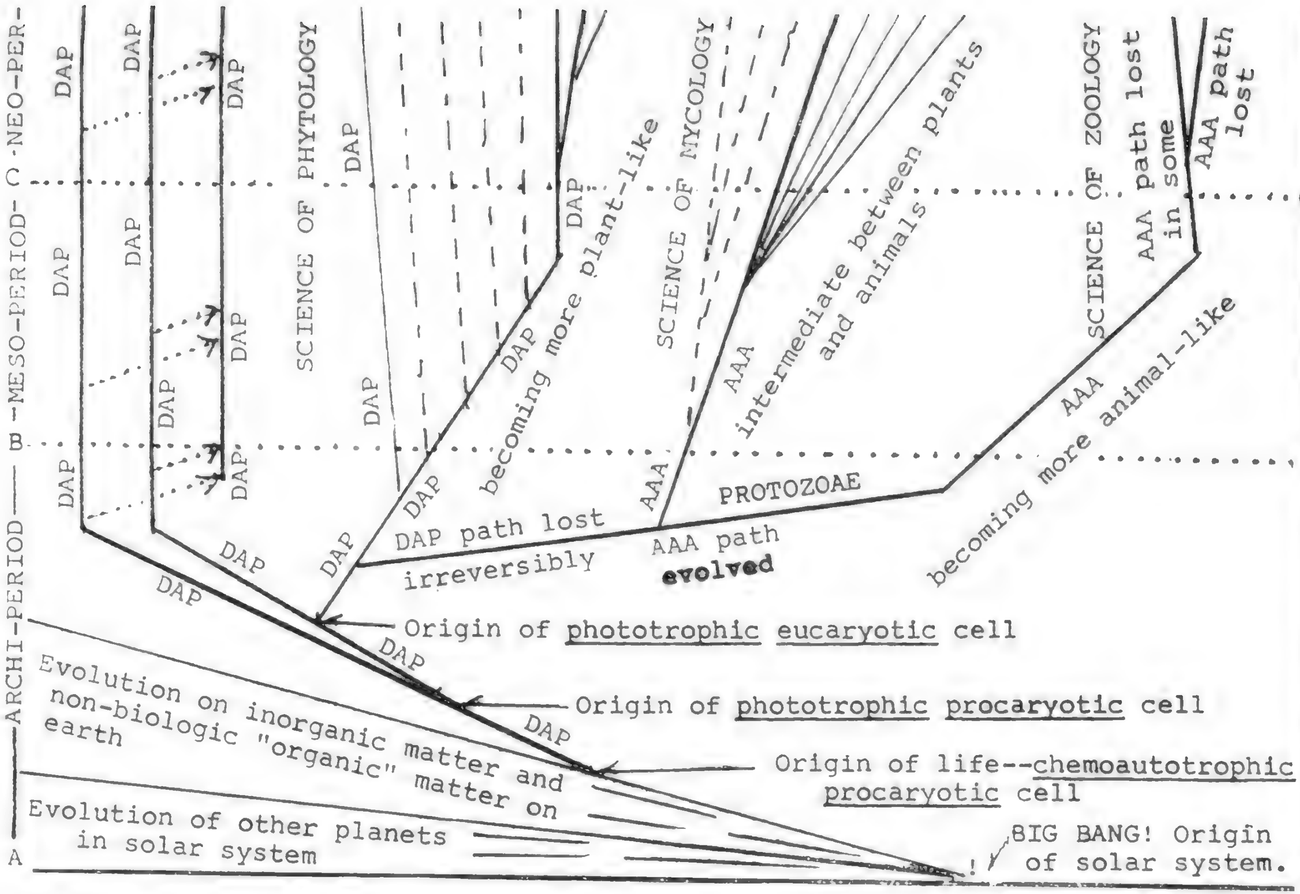


Figure 1. An overview of the 1964 Traub **earthbiology hypothesis (23)** as revised after corroboration by checking against the 1970 Vogel et al (4) lysine synthesis paths DAP and AAA data (as tracers) with minimum required changes in details. For further explanation of Figure see text discussions, pages 89-97. **Corrections:** the line for **Metazoae** is incorrectly drawn; it should originate from the **Protozoae** line below the B-B line; for "Traub, 1964(22)," read (23); for "evolution on inorganic", read "(of inorganic").

path altogether as the organisms became ever more animal-like, eventually culminating in the contemprary period *Arthropoda*, *Echinodermata* and *Chordata*, including in the last named, the higher mammals, with man, the reasoning mammal represented in the Genus *Homo*.

Thus the original Kingdom 1. *Procaryotae*(DAP) spawned Subkingdom 1. *Plantae* (DAP) (of Kingdom 2. *Eucaryotae*). Subkingdom 2. *Plantae*(DAP) spawned a lineage which lost the DAP path irreversibly, but which regained the capacity to synthesize lysine by the AAA path. An offshoot of this lineage became Subkingdom 2. *Mycotae*(AAA), intermediate between plants and animals.

The original AAA lineage evolved into the *Protozoae* lineage, with loss of AAA in some of its offshoots. One offshoot gave rise to the *Metazoae* with total loss of the AAA path.

The populations of these lineages in the contemporary period are represented on line D-D in Figure 1, including Kingdom 1. *Procaryotae* DAP, the Science of *Procaryology*, and Kingdom 2. *Eucaryotae* (DAP & AAA), the Science of *Eucaryology* (see Figure 1).

"PROTISTA" (OR "PROTOCTISTA", OR UNDER ANY OTHER GUISE) NEVER A KINGDOM MAKE! The primitive organisms that existed in the archi-period are properly referred to as protists (Protista), Gr. *protistos*, the first of all (*28*), and *protistology* is the science dealing with these early primitive forms of life, now long extinct, that evolved later into the contemporary lineages, line D-D in Figure 1. Some of these lineages (populations) advanced to a lesser degree above the primitive forms (protists). In the present paper, these are referred to as *relicts* (L. *relictus*, left behind). Thus we may speculate on the basis of *relicts* as to the nature of the earlier progenitors; however, we must not allow the imagination to run wild, but use such inferences with caution.

The study of the science of lineagics(*23*), the bioevolutionary process, the origin of the first lineage, its long history of branching to the present contemporary organisms, and their proper grouping, is a most difficult task to say the least, when the fossil record is scanty and reliance has often to be placed upon man's lively and sometimes not so consistent imagination.

He sometimes forgets that the contemporary *relict* populations (represented by line D-D in Figure 1) are no longer the same *protists* as the earlier forms, in the archi-period, from which they evolved, and cannot be picked out horizontally across line D-D (Figure 1) and collected in a mixed bag of relicts to form a realistic "Kingdom Protista" in the contemporary time frame.

Bioevolution means change *forward or retrograde* but the product will never again be the same at any future time. The genes and environmental factors are many in each case, and the odds against the possibility that these will ever again be the same at any future time are overwhelming!

The major phylons (phylum, subkingdom, etc., named earlier,

above, line D=D in Figure 1) represent units at the contemporary point in time with a long lineage back of each, and should never be confused with population groups at a different point in time, B-B, and C-C, for instance. Protista belong below line B-B, and should never be confused with contemporary lineages (population units) on line D-D. To confuse these involves a kind of reasoning outside the field of lineagics.

Those who propose "Kingdom Protista" err in confusing the groups in the contemporary time frame, along line D-D in Figure 1, with extinct groups below line B-B, and compound the error by selecting sometimes distantly related contemporary groups with the DAP or AAA lysine synthesis paths to form an unrealistic "Kingdom Protista."

IV. FUTURE COURSE OF RESEARCH IN LINEAGICS

It is clear that the future course of lineagic research has to banish the dead hand of the mediaeval past and boldly face the realities. Such a relatively new science as *genetics* could start out with a clean slate with a unified outlook, but this contrasts markedly with the science of *lineagics* (*23*).

The outmoded discipline of classification was instituted in an age when it was believed that organisms had been arbitrarily created and all that remained was for man to classify these fixed objects. The voice of a Mauterpuis to the contrary was unavailing (*23*). The emphasis was on the cart-before-the-horse classification.

With the advent of the theory of *bioevolution*, the study of this phenomenon is often considered as a separate discipline when in fact it is the back-bone, the very essence of the new science of *lineagics*, with the objective of tracing out the evolutionary *history* of living things, and on the basis of these facts eventually to arrive at not any classification but a *linoclassification* which is the end product. Thus, the emphasis is on *lineages, always lineages (23)*, not on the end product primarily. Thus, workers in this field are no longer classifiers alone, but first of all *seekers for lineages*, and thus *lineagicists*. This parallels the rediscovery in 1900 of Mendel's discovery of the principles of particulate inheritance in 1865. The geneticists benefited from Mendel's discovery and the science of *genetics* was born. The cart-before-the-horse classifiers failed to benefit from Darwin's "Origin of Species" (1859), and remained short-sighted classifiers, and missed a rendevous with science. The full significance of Darwin's contribution has only recently been tardily relized by those engaged in the field of *lineagics*.

Thus, it is clear that the future course in lineagic research is bound up with seeking out basic facts and basing conclusions on such data as the lysine synthesis paths DAP and AAA (Volgel et al, *4*). Our hypotheses have to be tested against such basic facts.

Lineagicists must ever be on the outlook for clues. For instance, the structural unit in fungi is a fine tube which grows apically, and this feature is found also in *a group* of the Grass Green Algae, the Order *Siphanales*. We, as lineagicists, immediately draw inferences and reason that Order *Siphonales* may be out of place in Phylum *Chlorophyta* and

probably branched off from Phylum *Euglenmycota*(AAA) and may not belong in Subkingdom 1. *Plantae*(DAP) but in Subkingdom 2. *Mycotae* (AAA). Only a test for the *presence or absence* of lysine path AAA in Order *Siphomales* can answer this question. It is hoped that someone with the required facilities will follow up this challenging lead.

It is also to be noted, as shown in Figure 1, lysine synthesis path data, under Subkingdom 1. *Plante*(DAP), are missing for four phyla of Algae, *Rhodophyta*, *Phaeophyta*, *Chrysophyta*, and *Pyrrophyta;* and under Subkingdom 2. *Mycotae*(AAA), for three phyla, *Myxomycota, Reticulomycota,* and *Communomycota.* It is hoped that some one with the needed research facilities will supply the missing information.

It is only by such laborious steps in the future that we can perfect the linoclassification of living things, never by mediaeval reasoning.

V. DISCUSSION

It was indicated earlier that the 1969 Whittaker report *(27)* was challenging in one particular to the 1964 Traub *(23)* lineagic hypothesis concerning earth organisms. The present paper should have appeared in 1971 but first things had to come first and it was delayed *(1)*.

In the meantime things have gotten somewhat out of hand with the considerable discussion about the grouping of the upper phylons of organisms on earth, started by the 1969 Whittaker report *(27)*, in which the artificial concept of "Kingdom Protista" was championed in the journal SCIENCE, without any mention of the earlier 1964 opposing *earthbiology hypothesis* of Traub *(23)*, which assumed the "Kingdom Protista" concept to be mediaeval and thus should have been dropped long ago.

During the period, 1963 to 1975 *(24, 23, 25, 26)*, and in the present paper, the writer indicated that there are only two real kingdoms of cellular organisms on earth. On the primary level, there are cellular organisms. Superkingdom 1. *Cellularae* versus non-cellular organisms, Superkingdom 2. *Acellularae* (viruses). On the secondary level, there are two possible kingdoms, those with the *procaryotic* cellular organization, Kingdom 1. *Procaryotae* versus those with the *eucaryotic* cellular organization, Kingdom 2. *Eucaryotae.*

Grouping No. 2, given earlier in this paper, is *briefly* summarized here as Grouping No. 3 for convenient reference in the following discussion.

GROUPING NO. 3. Higher phylons of living things (Traub, **1964**, **23**), See also Grouping No. 2.

Superkingdom 1. **Cellularae**—celluar organisms (primary level)
  Kingdom 1. **Procaryotae** (secondary level)
    Subkingdom 1. Autobacae (tertiary level)
      Infrakingdom 1. Chemoautobacae (quadrinary level), etc.
      Infrakingdom 2. Photoautobacae
    Subkingdom 2. Heterobacae (bacteria)
  Kingdom 2. **Eucaryotae**
    Subkingdom 1. Plantae
      Infrakingdom 1. Anembryophytae (Algae)
      Infrakingdom 2. Embryophytae (bryophytes and tracheophytes)

Subkingdom 3. Animalia
Superkingdom 2. **Acellularae**—Viruses.

It was indicated as a caution *(26)* by Traub that the categories of the higher ranks of living things can be shuffled (by slipping in an extra category, for instance, the term Dominion) so as to make it appear that there are various numbers of so-called "kingdoms", but this is only a game of shadow-boxing or musical chairs, as shown by the Grouping No. 4.

GROUPING NO. 4. The higher ranks of living things shuffled so as to obtain five so-called "kingdoms" Traub (26) 1975.

Dominion 1. Cellularae
Superkingdom 1. Procaryotae
Kingdom 1. Autobacae
Kingdom 2. Heterocacae (bacteria)
Superkingdom 2. Eucaryotae
Kingdom 1. Plantae
Kingdom 2. Heteroplantae (fungi)
Kingdom 3. Animalia
Dominion 2. Acellularae (Viruses)

It will be noted that nothing but confusion can be gained by such a maneuver. The so-called "Kingdoms" Plantae, Fungi and Animalia, which are given an unreal stature when they are in fact three kinds of organisms all having the eucaryotic cellular organization under the Kingdom *Eucaryotae (23)*; see Grouping No. 3.

In 1969, Whittaker *(27)* proposed a five-kingdom grouping of cellular organisms, as shown in the following bare outline.

GROUPING NO. 5. Adapted from the figure after Whittaker (27) Five-kingdom grouping. See also original paper (27).

Kingdom Plantae — Kingdom Fungi — Kingdom Animalia

Kingdom Protista

Kingdom Monera (=Procaryotae)

It is to be noted that this figure lacks the essential time dimension in the evolutionary process and it gives the impression that lineages are piled on lineages when in fact he is considering population units on line D-D in Figure 1 of Section III of the present paper which represents contemporary groups. The reader should consult also the original Whittaker figure *(27)* because it is not possible to include here the lines of descent for the various lineages.

In the following discussion, the lysine paths DAP and AAA have been added by the present writer. These serve as tracers.

Whittaker is correct in showing the origin of the *Chlorophyta* (DAP) lineage from lineage *Cyanophyta* (DAP) as the main line of descent for Plantae (DAP), but he fails to indicate that *Bryophyta* (DAP) and Tracheophyta (DAP) are later offshoots from the main

stem for he has *Chlorophyta* as an offshoot of *Tracheophyta*.

Phylum *Euglenophyta* (=*Euglenmycota*) (AAA) is misplaced and mislabeled as "Protista" below Plantae (DAP). It should provide the main contemporary *relict* lineage leading to Fungi (AAA). See Figure 1 of the present paper.

The main *Animalia* lineage should be AAA, leading to *Protozoae* (partial loss of AAA), which is not shown. Instead *Zoomastigina, Sarcodina, Cililiophora,* etc., are shown as Protista. The *Metazoae* (AAA lost) lineage should be shown branching off from the *Protozoae* (AAA), instead it originates separately, ending in *Arthropoda* and *Chordata*.

His Kingdow Protista includes Phylum *Euglenophyta* (AAA), belonging to Subkingdom 2. *Mycotae* (AAA); the algal phyla *Chrysophyta* and *Pyrrophyta,* belonging to Subkingdom 1. *Plantae* (DAP), and groups *Zoomastigina, Sarcodina, Ciliiophora,* etc., of the Infrakingdom 1. *Protozoae,* which have mostly the AAA path, *some* having lost it by evolution; all belonging to the Subkingdom 3. *Animalia*.

Most of the difficulties will be cleared up when he inserts the time dimension in his figure as shown by Figure 1 of Section III of the present paper. Then all populations of contemporary lineages will be on line D-D and the "Kingdom Protista" vanishes.

In 1967, Sagan *(29)* and later under the married name, Margulis *(30, 31)* entered the lengthy roster of those who since 1882 have sought to answer the question of the origin of the *eucaryotic* from the *procaryotic* cell. She also (Margulis, *32, 33, 34*) became an advocate of the 1969 Whittaker *(27)* 5-kingdom grouping including the Kingdom Protista.

In 1971, Margulis *(32)* offered a somewhat more hazy form of the Whittaker *(27)* grouping *without showing the time dimension, and without definite lines of descent,* and with Kingdom *Fungi* placed after Kingdom *Animalia* which is unrealistic because the Fungi are intermediate between plants and animals. Otherwise the same criticisms leveled against the original Whittaker *(27)* system apply here also.

Leedale *(34)* in 1974 proposed a grouping similar to that of the Whittaker *(27)* system but with Kingdom Protista removed.

GROUPING NO. 6. Adapted from 1974 Leedale **(35)**; see also original **(34)**.

Kingdom Plantae	Kingdom Fungi	Kingdom Animalia
	Kingdom Monera (=Procaryotae)	

Leedale is to be congratulated on eliminating Kingdom Protista and thus remaining on the right track. With the time dimension added, his figure will approximate in essence the 1964 Traub *(23)* grouping (see groupings Nos. 2 and 3 above).

In 1976, Margulis *(34)* proposed a further revision of the 1969 Whittaker *(27)* grouping.

GROUPING NO. 7. Adapted from Margulis **(34)** 1976 revision of the 1969 Whittaker system **(27)**. See also original **(34)**.

Superkingdom **Prokaryota**
  Kingdom Monera (= Procaryotae)
Superkingdom **Eukaryota**
  Kingdom Protoctista (replacing Protista)
  Kingdom Fungi
  Kingdom Animalia
  Kingdom Plantae

In general outline, when Kingdom Protista is deleted, this system is similar to the 1975 variation of the Traub *(23)* grouping (see groupings Nos. 2, 3 and 4, above). However, *Plantae* (DAP), spawned by the *Procaryotae* (DAP) is hopelessly out of place at the end after *Protista, Fungi* (AAA) and *Animalia* (AAA).

Margulis' Kingdom Protoctista contains *Euglenophyta* (AAA), *Chlorophyta* (DAP), etc. to the number of 31 phyla (the markers DAP and AAA have been added by the present writer). This is an aggregation of sometimes unrelated groups (DAP and AAA) and is not a natural biological kingdom.

The present writer has not been privileged to see the *(36)* Whittaker (in press 1975) report. However, from the discussion about it in the 1976 Margulis *(34)* report, it appears that no fundamental changes have been made in the Whittaker Grouping No. 5 already discussed.

It is obvious that the concept of Kingdom "Protista" or "Protoctista" is untenable and has to be abandoned following the lead of Leedale *(35)* to regain the right road.

VI. SUMMARY AND CONCLUSIONS

1. The available data on lysine synthesis paths DAP and AAA corroborate the 1964 Traub grouping of the higher phylons of cellular organisms (Cellular Biology), requiring only a minimum of revision in details.

2. The untenable nature of the "Kingdom Protista or Protoctista" concept has been revealed.

3. The segregation of the archi, and meso-period eucaryotic heterotrophs (parasites and saprobes) of Subkingdom 1. *Plantae* under Subkingdom 2. *Mycotae*, is no longer tenable since neo-period heterotrophs, *Cuscuta* (Dodder), etc., were formerly retained under *Plantae*, and archi-, or meso-period heterotrophs, Phylum *Hydotophyta*, are now recognized under *Plantae*, and the photo-autotrophic Phylum *Euglenmycota*, has been placed under *Mycotae*.

4. An overview of the higher phylons (Superkingdom, Kingdom, Subkingdom, Infrakingdom and Phylum levels) evolving in the time frame, has been presented in a single figure.

5. In fairness to the student, the Science of Earthbiology should be taught as a whole, never fragmented, below the college level.

6. A text unifying the entire Science of Procaryology is very urgently needed; and texts on Phytology, Mycology and Zoology should be

brought up-to-date on the basis of the unifying role of lysine synthesis paths.

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1. This paper was inspired by the 1970 paper of Vogel et al(**4**) and should have been published in 1971 when the first draft was made. However, in appreciation of the many benefits received by the writer in the climate of relative freedom existing over two centuries in the United States as a result of the statesmanship of the Founding Fathers, the writer was duty bound to take out several years to complete the seven-libretto operatic cycle, **The Call-of-Destiny,** the musical score to be provided by the composer. The Cycle details the grand panorama of **the American Epic,** the training of the charismatic leader Colonel Washington, in the French and American war, 1755-1763; the winning of freedom under the persevering General Washington; the formulation of the American Constitution on the basis of consensus and compromises, with checks and balances and the Bill of Rights to protect the rights of all, including the minority, and its adoption in 1788; the two-term presidency of President Washington, who presided over the first great successful experiment in self-rule over a continental area. After Washington's death in 1799, the role of the Judiciary being in danger, Chief Justice Marshall asserted the co-equal status of the Judiciary with Congress and the Presidency, completing the unique form of the American government. Under the Presidency of Thomas Jefferson, the future growth pattern of the American Republic was envisioned when he boldly purchased the vast French Colony of Louisiana from Napoleon in 1803, and sent out the Lewis and Clark Expedition which reached the Mouth of the Columbia River in 1805, assuring American expansion to the Pacific. The mold was set for the future functioning of the American Republic.

During the hiatus of the composition of the American Epic, the writer's research in plant science was somewhat curtailed, and the subject of the upper ranks of living things got somewhat out of hand when the mediaeval concept of "Kingdom Protista" was again taken seriously by some workers, from 1969 to the present. The writer begs to apologize for his absence and failure to help in checking this unnecessary discussion which took up so much valuable space in the scientific journals.

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ADDENDUM

After the above article was set up, separates of Prof. Margulis' publications were kindly furnished. One of these, "The Classification and Evolution of Procaryotes and Eucaryotes", Handbook of Genetics,

edited by R. C. King. Vol. I. Plenum Press. 1974, pp. 1-41, was particularly helpful. In this Prof. Margulis does include figures 1 through 4 which show the time dimension in relation to the phylogenies (including the 5-kingdom Whittaker system) based on Margulis' *admittedly unverified "cell symbiosis theory"*, which it is claimed, leads to the 5-kingdom Whittaker type grouping (see her figure 4). This however is unrealistic in the light of the Traub earthbiology hypothesis which is verified on the basis of the 1970 Vogel et al *(4)* lysine synthesis paths DAP and AAA data.

CHRYSOCORYNE: A NEW CHILEAN GENUS OF AMARYLLIDACEAE

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Investigating the Chilean genus *Leucocoryne* of the Amaryllid-family, we detected some species which had been considered as *Leucocoryne*, but they differ notably from this genus. Analyzing them, especially fresh material, we could observe, that the 2 species, described by R. A. Philippi—*Leucocoryne oxypetala* and *Leucocoryne incrassata* presented fundamental differences within the genus *Leucocoryne*. *Leucocoryne* has 3 fertile anthers, of elongated form, but in the two species mentioned above there are 6 fertile anthers of an oval form. In *Leucocoryne* there are 3 lobe-like filaments, inserted in the throat of tepaltube. They appear as a metamorphic structure, of three stamenoids. In the 2 species mentioned above, the 6 fertile stamens are distributed in 2 cycles, in the interior of the tepaltube. The 3 lobes, of a more broad and fleshy type, must be considered as a *paraperigone*, which is a very common structure in the Amaryllid-family and is observed in the Chilean genera: *Placea*, *Miersia*, *Phycella*. This paracorolla has a conic form or is bifid and has a dark orange colour. These differences induced me to establish the new genus *Chrysocoryne*. (chryso = golden; coryne = club.)

GENUS **CHRYSOCORYNE** ZOELLNER

Mus. Hist. Nat. Valparaiso. No. 6. 1973, pp. 17-30. Generic type: *Chrysocoryne oxypetala* (R. A. Phil.) Zoellner. syn. -*Leucocoryne oxypetala* R. A. Phil. type specimen: SGO 46765

Description: Herbaceous plant with bulb; *bulb* globose, pear-shaped, covered with dark brown tunics and fibres. Bulb with long subterranean neck. *Leaves* linear-striated, glabrous with obtuse apex. *Scape* slender, cylindric. *Spathevalves*, 2, lanceolate, of greenish colour, when dried whitish veined. *Pedicels* slender, cylindric. *Flowers* in umbels.

formed by a funnel-shaped tube and 6 tepalsegs of white colour, reflexed. *Tepaltube* cylindric, veined longitudinally by six veins. *Tepalsegs* lanceolate with acute apex and of white colour. *Paraperigone* with 3 or 6 lobes, inserted in the throat of tepaltube, conic-shaped or bifid, fleshly, length is 1/3 of tepalsegs. The 3 greater exerescences in front of petepalsegs, the 3 smaller ones in front of the setapalsegs or are missing. Lobes dark orange coloured. 6 *stamens* in 2 cycles inserted on the inner side of tepaltube, without any filament, oval-shaped. The lower stamens in front of the 3 setepalsegs, the 3 upper stamens in front of the petepalsegs. One *style* with a *stigma* of capitate form. *Fruit* is a *capsule* with 3 valves and many black seeds.

KEY TO GENERA RELATED TO **CHRYSOCORYNE**

1a. Perfect stamens 6:
  2a. Tepultube without a paraperigone .... **Tristagma**
  2b. Tepultube with a paraperigone .... **Chrysocoryne**
1b. Perfect stamens 3, sterile stamens 3(stamenodes) .... **Leucocoryne**

KEY TO THE GENUS **CHRYSOCORYNE**

1a. Paraperigone 3-parted, lobes conic, apices obtuse, umbel 5—9-flowered, pedicels, unequal, tepalsegs lanceolate, yellowish-white ...1. **oxypetala**
1b. Paraperigone 3-parted, lobes conic, apices bifid, and lesser lobes 3, conic, often missing; umbel 2—4-flowered, pedicels unequal, tepalsegs elliptic, pure white ....2. **incrassata**

CHRYSOCORYNE OXEPETALA (R. A. Phil.) Zoellner

Anal. Mus. Hist. Nat. Valparaiso No. 6. 1973, pp. 20-22.

Herbaceous plant with bulb. *Bulb* globose pear-shaped, 2 cm high and 1.5—2 cm diameter covered with dark brown tunics and fibres. Bulb with long subterranean neck, length 8—15 cm *Leaves*, 2 or 3, linear, striated, with 13—16 parallel nerves, fleshy, glabrous, with obtuse apex, 15—20 cm long, 3.5—5.5 mm broad *scape* cylindric, glabrous, striated, with a diameter of 2—2.8 mm and a length of 15—25 cm 2 *spathes*, membranous, of lanceolate form, with acute apex, of greenish colour, when dried whitish, veined, 3—3.5 cm long and 4—4.5 mm broad. *Pedicels* cylindric, unequal, 5—9, 1.6—6.5 cm long. *Flowers* in umbels of yellowish white colour. Flowers formed by a funnel-shaped tube and 6 tepalsegs. *Tube* cylindric, striated with dark green nerves, tube 1—1.4 cm long and 1.5—2 mm in diameter. *Tepalsegs* in 2 cycles, reflexed 3 setepalsegs, lanceolate with acute apex, with a green nerv in the middle of *setepalseg*, 0.8—1.2 cm long and 0.25—0.3 cm broad. *Petepalsegs*, lanceolate, with acute apex, with a green nerv in the middle, tepalsegs 0.8—1.1 cm long and 0.25—0.3 cm broad. *Paraperigone* with 3 lobes, of conic form and obtuse apex inserted in the throat of tube in front of petepalsegs, 3.5—5 mm long 1.5—2 mm broad orange colour. The colour of the lesser lobes darkens by drying process. 6 *stamens* in 2 cycles without filaments. Upper anthers inserted in the funnel tube, in front of petepalsegs, of oval

Fig. 23. Genus **Chrysocoryne** Zoellner. **Top - C. incrassata** (R. A. Phil.) Zoellner; **bottom - C. oxypetala** (R. A. Phil.) Zoellner.

form, of yellow colour, 1.5 mm long, 8—9 mm elevated above of the base of tube. Inferior anthers inserted in the tube, in front of the setepalsegs, oval formed, 1.5 mm long, of yellow colour, 6—6.5 mm distant from the base of tube. 1 *style, ovary* cylindric, striated by 6 nerves, ovary 4—5 mm high, *stigma* globose. *Capsule* cylintric, trivalved, with persistent style, glabrous, with 6—8 seeds in each valve. *Seeds* of black colour, 1 mm in diameter.

Type: This specimen has been collected in the North of province Coquimbo, in hills of Coastal Cordillera.

Leucocoryne oxypetala R. A. Philippi, Caldera, IX-1885 (SGO 46765), *type*. *Chrysocoryne oxipetala* (Phil.) Zöll. in Pass of Pajonales, 9-X-1965, O. Zöllner (Herb Zöll.-6401).

CHRYSOCORYNE INCRASSATA (R. A. Phil.) Zoellner

Anal. Mus. Hist. Nat. Valparaiso No. 6. 1973, pp. 22-25.

Herbaceous plant with bulb. *Bulb* pear-shaped with tunics, chestnut coloured. 1.2—1.6 cm in diameter and 1.5—2 cm high. Subterranean neck covered with dried leaves, 6—10 cm long. *Leaves*, 2 or 3, contemporary with the flowers, fleshy, linear, glabrous, striated, with obtuse apex, 3—4.5 mm broad 12—25 cm long. *Scape* cylindric, striated, 8—25 cm long and 2—3 mm of diameter. *Spathes*, 2, reflexed, lanceolate, striated, with acute apex, 3—3.5 cm long and 0.4—0.45 cm broad. *Pedicels* 2—4, subequal, cylindric, 1 mm in diameter, 1.3—3.5 cm long. *Flowers* funnel-shaped with six tepalsegs in 2 cycles. *Tepaltube* striated by 6 nerves which are elongated to the tepalsegs, of greenish colour. Tepaltube, 1—1.2 cm long, 2—3 mm in diameter. *Setepalsegs*, lanceolate, reflexed, white coloured, striated by a green nerve. Setepalsegs 1.1—1.5 cm long and 0.4 cm broad. *Petepalsegs*, lanceolate, reflexed, 1—1.2 cm long, and 0.3—0.4 cm broad. *Paracorolla* formed by 6 lobes, 3 greater ones, 3 smaller ones, missing often (these last ones), lobes bifid, the incision arqued or acute, inserted in front of petepalsegs, in the throat of the tepaltube, yellow to orange coloured 2—3 mm high, 1.5 mm broad. Smaller lobes conic, with acute apex, inserted in front of setepalsegs, 1 mm high and 1 mm broad. 6 *stamens*, fertil, in 2 cycles, without filaments, inserted in the wall of tepaltube, of yellow colour. Inferior anthers in front of setepalsegs, 4 mm above the base of tepaltube. Upper anthers in front of petepalsegs, inserted 7.5 mm above the base of Tepaltube. *Anthers* 1.6—2 mm long. 1 *style, ovary* cylindric, trivalved, 2 mm high. *Stigma* globose. *Capsule* cylindric, formed by 3 valves. 4—6 seed in each valve, of black colour.

Type: *Leucocoryne incrassata* R. A. Philippi, Vallenar Prov. Atacama, II-1883 (SGO.-46775). *Chrysocoryne incrassata* (Phil.) Zöllner: Taltal, prov. Antofagasta 17-IX-1967, O. Zöll. (Herb. Zöll.-6333). This specimen was observed in several places on the Coastal Range of Cordillera between Antofagasta and Caldra. The date which has given R. A. Philippi (February 1883) must be erroneous. The author has studied during several summers the zone of Vallenar, but

could not discover any green bulbous plant in this semi-desertic

APPENDIX

Tristagma dimorphopetala C. Gay (Hist. Fis. Pol. Chile, V and illustrated in Atlas Bot, Lam. 69, cited in Herbertia 12:57. 1 a *Chrysocoryne oxipetala*, for having 6 stamens and a fleshy pa gone, 3-lobed, lobes conic.

DR. HOWARD MEXICAN PLANT COLLECTIN TRIP, 1972

JAMES A. BAUML, *130 Melba*
San Antonio, Texas 78216

With the summer of 1972 came another opportunity for joinin Thad Howard on a plant collecting trip into Mexico. Again I de in the affirmative. Steve Lowe, a friend of Dr. Howard and me several years, and a junior in horticulture at Southwest Texas S University, likewise received and accepted the invitation to take two-week trip. We packed Dr. Howard's new VW bus with all anticipated supplies and left San Antonio at 6:00 P.M., Fri August 4.

ITINERARY

Our route had been designed to include travel through the state Sonora, previously untraveled by Dr. Howard. We planned not on to obtain an idea of the composition of plant life, but also to attempt collection of *Hynenocallis sonorensis* Standley, described from Alam southern Sonora, and Rio del Fuerte, in northern Sinaloa. Fro Sonora, we had plans for following basically the same path as last yea through Nayarit, Jalisco, and Colima along the coast, and then acros Michoacan to Guerrero and hopefully as far as Oaxaca.

NEW MEXICO AND ARIZONA

Saturday we had traveled through New Mexico, and we made our first plant investigation at Texas Canyon in Arizona. Though *Zephranthes longifolia* and *Brodiaea* could not be spotted, a two-foot yellow *Anthericum* and *Milla biflora* did appear though in very small numbers. East of Tucson, colonies of Ocotillo, Barrel Cactus and Sahuaro Cactus became more common.

SONORA

After lodging at Guaymas, our next day's journey took us to Navojoa and then to Alamos for the northern AMERINDIAN LILY *Hymenocallis*. No *Hymenocallis* could be found, and Alamos disappointed us as a town. We ate lunch there none the less and drove west and then south again on Highway 15 into northern Sinaloa.

SINALOA

Far from having given up our search for the northern Amerindian Lily, we turned northeast from Los Mochis on the road parallel to Rio del Fuerte. The flashes of white in the roadside ditches a few miles south of El Fuerte told us we had found some kind if *Hymenocallis.* We pulled off the road to investigate. We found the plants in bud, flower and fruit. While I gratefully pressed specimens, Steve and Dr. Howard braved the muck and retrieved several bulbs. Variations among the flowers amazed us all, as cup size, anther color, tube length, petal length and even color differed considerably between extremes. This plant Dr. Howard had known as *H. sinaloaensis* from La Cruz, (southern Sinaloa). We continued through Los Mochis to Culiacan where we rested for the evening .

By 8:30 the next morning we had commenced the drive to Mazatlan, and by noon we had arrived at the city limits. Outside the city, the road branched, so we took the road labeled "Playa Mazatlin," the Mazatlan beach. This fortunate decision netted several finds, namely, *Milla biflora, Bessera elegans, Cipura, Hymenocallis sonorensis* Standley, and an escaped *Crinum* cultivar, "Empress of India."

NAYARIT

Into sandy lowland country we drove that afternoon to search for the interesting Irid, *Cypella rosei.* Both *Milla biflora* and a new *Bravoa* species appeared with *Cypella.* The day closed for us in Tepic where we stayed for the nigth.

Along the road to Puerto Vallarta the next day, we collected several interesting terrestrial orchids including a little yellow *Habenaria,* a four foot creme and purple Bletia-type, a bronzy-leafed orchid with tunicated corms plus a fragrant white Aroid. *Hymenocallis azteciana* Traub appeared along this road blooming both within sight of the highway and further back in the shade under thicketized vegetation. With interest we found some plants blooming without leaves, and we noticed that the characteristic white tube often contained an infusion of green in the lower portion. Two scapes exceeded four feet in height!

We relaxed in Puerto Vallarta at Jack's Restaurant before starting our return to Tepic. Aften dinner we almost left the state of Nayarit, but we decided to stay at Ixtlan del Rio. When I awoke the next morning from a deep sleep, Steve and Dr. Howard reported how the marching of a Mariachi band lead by its three gleeful inebriated part-time employers had disturbed their early morning slumbers. Old Mexico is quite a place!

Not far past the Nayarit-Jalisco state line we found with some difficulty the colony of exceptionally large *Hymenocallis horsmannii* Baker of the 1971 trip. At that late date seeds had dropped and foliage had begun to yellow. Likewise, a *Bessera* collection site of the previous year we located only by a few dried seed pods. At Km. 94 *Milla biflora,* a few *Polianthes* in bud and fruit, *Tigridia passiflora,* a *Manfreda* species, and an *Oxalis* appeared. The *Millas,* not ripening as quickly

as *Bessera*, could still be spotted by their upright stalks.

Magdelena children greeted us with smiles and opals of all assorted shapes, sizes and colors as we pulled to a stop there. All three of us succumbed to the "fire" in the stones and bought several samples as souveniers. And just down the road at Tequila, home of several brands of the potent brew, we again lost pesos in the interest of science.

Guadalajara was beautiful, but time limited our sight-seeing. We headed south through Ciudad Guzman in lush orchid and begonia country toward Colima. At Km. 38 and a few kiometers further grew *Hymenocallis acutifolia* (Herb.) Sweet and *Hymenocallis* "hannibalii". Both were in flower. The late hours and darkness dictated that we wait for morning to collect them.

COLIMA

After breakfast the Volkswagon bus took us from Colima on the short route toward the coast. Only five km. south of the city in a plantation of unusual trees with very hard round shiny green fruits we found three species of *Tillandsia* bromeliads and one species of *Epidendrum*. At km. 18 were purple *Bessera*, the *Hymenocallis species*, terrestrial orchids in leaf, ferns and *Selaginella*. An interesting *Begonia* with an eighteen inch leaf, hirsite on the back, also grew here.

At km. 22.5 grew a Tradescantioid with colorful variegated leaves and a *Begonia sp.* with leaves speckled red. In the same little steep ravine we collected the dwarf *Sprekelia* in leaf and an Aroid with elephant-ear type leaves.

By late morning we turned back toward Colima. We easily spotted a colorful *Pinguicula* sp., the carnivorous butterwort, by its bright pink to rose-purple flowers, growing tenaciously along a flat lime stone face. Besides having colorful flowers, some individual rosettes assumed a bronzy tint. And just up the road we stopped to search for the yellow *Nemastylis convoluta* in the same location as in 1971. Its delicate deep stems made collection difficult, but a generous seed supply offset the dearth of obtainable bulbs.

After stopping again in Colima for a late lunch we headed north and climbed a "Microondas," a TV tower road, the first of several. Winding round and round up the mountain on the brick roadway we found a large *Bessera* colony in leaf along with a few isolated scarlet bloomers. A *Hymenocallis*, probably *H.* "Hanniballi" grew nearby. At the top, a church still under construction along with the television tower greeted us. On the descent back to road level, Steve yelled, "Bravoa!" and we quickly stopped and pulled to the side of the road to investigate. A *Bravoa* it was. This new species appeared very different from any other members of the genus. Distinct black stripes covered 1/3 the length of the tubular red and green flowers. Again I pressed specimens while Steve and Dr. Howard took a sample of the plants. Mature bulbs were long and slender, easily broken with digging.

Our last stop in Colima came at Km. 204 where the dwarf *Hymenocallis sp.* #65-48 had been found on earlier trips. Steve and I found

the semi-dormant bulbs with yellowed leaves after scanning the ground carefully.

JALISCO

Another *Begonia* awaited our discovery at km. 191. Flowers ranged in color from white to red, and some plants had leaves with red margins. These grew in damp dark fluffy soil in shady spots above the road.

Outside the city of Pihuano we saw more *Tillandsias* and also a rainstorm and hail. Before km. 144, we had noticed *Bravoa gemniflora* and *Tigridia pavonia*, the Mexican Shellflower. At km. 140 grew *Hymenocallis acutifolia*. The weather had turned quite chilly by the time we stopped to eat supper in Manzanitla. With coats buttoned securely we sat down to eat at a small restaurant in the town square To add to the culinary pleasures of our meal, our waitress suggested "crema" for our food. The sour cream she brought did taste good on our pork and sweetbread, and we were introduced to another regional Mexican custom.

As another interesting sidelight here, an old lady with a beautiful ollection of tuberous begonias allowed us to tour her garden when we howed great interest in the plants which covered her porch. Not only id she grow imported Begonias but also *Hymenocallis*, succulents, *uschia*, *Tigridia*, *Brunsvegia*, and others.

MICHOACAN

Passing through San Jose de Gracia, we stopped at another resi-ce to inquire about yellow *Tigridia pavonia*. This lady too kept a garden and admitted that people often stopped to see her plants. agreed to trade some *Tigridia* bulbs and seeds for an offset from our *ums* and a *Hymenocallis* bulb.

Outside the village, we began seeing bush morning-glory plants deep purple flowers having a white throat. As no seeds had ed on the plants, we were forced to leave with no hope of growing eautiful bushes in our gardens. Scattered among the morning-s grew a *Milla* species with short stem and long tube. We collected at km. 28.

t the site of the 1971 collection, a wet clay sloping hillside at km. e again found *Hymenocallis mexicana*. Grazing had taken its leaves and we spotted the nubs of leaf with difficulty.

st the village of Zapoca we recollected a white-flowered stoloni- *Allium sp.* It grew by the thousands in the damp ditches on es of the highway. Our next stop netted two species of tuberous one which pleased Dr. Howard a great deal with its fragrance. orted pink flowers but differed in leaf shape and coloring of s.

veen km. 85 and 86 we turned from the main highway onto a road which eventually took us to a secluded cornfield where utiful tall corn plants thrived. While traveling this road we o collect dark maroon Dahlias. Dr. Howard then spotted a

tiny white terrestrial orchid, probably *Habenaria*, only about five inches tall. Steve enthusiastically dug samples and wrapped them in sphagnum moss for safekeeping. A glaucescent *Sprekelia* in leaf grew in the rocks at the road's end. In the same area were a strange Manfreda-type plant with pendant green flowers, a Bletia-type "hooded flower" orchid, *Bravoa geminiflora*, and a red-purple *Penstemon*.

The tasty native whitefish and native wares at Quiroga helped us decide to eat supper and shop in that city. All three of us unloaded many pesos on gifts and souveniers. We made one last collection before arriving in Morelia when Steve's eye caught the yellow, orange and red flowers of an *Echeveria* growing along the rock wall just outside the city.

After an early breakfast downtown, Dr. Howard drove us to the VW agency at the outskirts of town in order to leave the bus for its 1,000 mile check-up. We then hopped on a city bus which took us into town for sightseeing. In Morelia, we toured the cathedral and stumbled on the state museum of Michoacan with a large display of Indian relics. Back to the shop we went, and the bus was ready.

Not far from town at Puerto de los Capuertos, km. 233, a tall hillside, suspected home of *Tigridia multiflora*, called us upwards. By the time we reached the top of the steep grassy hill, the air was thin and cooler. Along our climb, we had seen the *Echeveria* of the previous day, a tiny purple *Nemastyllis sp.*, *Calochortus barbatos* with its hairy yellow flowers, terrestrial orchids and *Bravoa geminiflora*. Slightly down the hill on the other side, we found *Tillandsia recurvata* and *T. atroviridipetala* and a large number of *Calochortus* in bloom. Carefully we made our way back down, loaded the bus, and drove on, confident of a solid sleep that night after the long hike.

A quick stop at km. 223 netted an Arisaema-type aroid with a speckled stem.

On the left at around km. 216 we stopped for snapshots of a beautiful waterfall. Its waters cascaded hundreds of feet into a lush, stream bed and ravine below. Rock walls along the winding mountain highway dripped with cool water and we saw ferns, begonias, and a yellow *Spiranthes* orchid. At km. 205 past El Alamo we came into pine forest and collected an *Echeveria species* growing on the rock faces of the roadside.

An interesting eating spot, the Quinta Mitzi, at km.123 provided excellent homegrown vegetables and Angus beef for lunch. Two women, a mother and her daughter from Chicago, both avid gardeners, owned the restaurant and gardens on the property. As gardeners will do, we traded interesting plants from one another's collections. They exchanged *Crinum augustum*, *Crinum moorei*, *Hedychium*, and a miniature *Gladiolus* for our *Besseras*, *Crinum*, *Milla*, and a *Hymenocallis*. Not far from this restaurant we stopped and collected *Tigridia meleagris*. Also, of special note, we found in bud a *Milla* species unflowered many years until 1972 under cultivation, which was here in bud. This form or species had what appeared to be stolons rather that offsets for vegatative increase, and resembled *Milla biflora* both here and at home.

MEXICO

Dr. Howard took Steve and me on an interesting side trip to an extinct volcano Nevado de Toluca. From pines we passed the Timber line to an altitude of low grassed and alpine flowers, past bleak rocks to more grasses and finally to the lakes at the top, Lake of the Moon and Lake of the Sun. Air had become cold and thin and clouds past in eerie procession across the lake from us.

MORELOS

Back down the highway we began finding more interesting plants beginning at km. 47. There we saw the bright red -purple flowers of a *Pinguicula* species against a rock wall. Four kilometers later two *Oxalis* species grew mixed among one another. *Oxalis deppei* sported green stems and basal offsets while the other species increased by stolons and had red stems. On the same stop we found a fantastic terrestrial orchid several feet tall, whose spike of yellow flowers covered a purple stem. Here, too, we saw the only tree fern of the trip.

Between km. 63 and 64 Steve's eyes brought the bus to a quick halt. He had spotted what appeared to be a tall, dark purplish-blue *Nemastylis*. In actuality, it turned out to be an uncommon Irid, *Sphenostigma longispathum*, never before collected by Dr. Howard. In the same area grew a bronzy-leafed terrestrial orchid with a big green lip, a member of the Crassula Family, perhaps *Cotyledon*, *Calochortus* in bud, and a *Manfreda* with narrow spotted leaves.

Since rain could be seen approaching, we had to cut digging short and move on toward Temascaltepec in search of *Hymenocallis Harrissiana*. One last stop outside the city netted *Bessera*, a wine and gold *Calochortus* species, and *Tigridia ehrenbergii*.

No *Hymenocallis* appeared on our drive south after dinner, so we drove back to Toluca and from there to Ixtapan de la Sal. Many *Milla* and *Bessera* and orange *Stenorynchus* orchids grew from km. 68-78. We voted unanimously to keep on driving toward Taxco, even though darkness had set in. We took advantage of being in this beautiful mountain city and ate well, enjoyed mariachi music, and the next morning toured the market place.

Past Iguala, in the vicinity of km. 45, we pulled off the road and searched through the wooded hillsides for *Dandya thadhowardii*. Dr. Howard found them, but the corms had already-withered leaves and we saw no bloomstalks.

An interesting phase of the trip began with our turning east from Chilpancingo toward Tlapa. At km. 5, we each took a bag and a pick or shovel and took off up a ravine from the roadway. We each found something exciting and different by the time we all met again about twenty minutes later. Among the plants were two different *Pinguicula* species, one with long thin leaves in a rosette rather than the normal flat wide leaves, at least six terrestrial orchids, an orange and red speckled *Achimenes*, *Bravoa gemniflora* and a giant *Bravoa* specimen, much larger in all its parts than any others on the hillside, a *Schoeno-*

caulen and many ferns.

Five km. further on a hillside with scattered *Agave* plants we collected a little white *Achimenes* with purple throat which grew into the light from under or out of cracks and holes of large rocks and a *Spiranthes* orchid species. In the vicinity of palmetto and ferns grew a succulent, *Thompsonella,* in both green and purple forms, *Sessilanthera,* and bromeliads.

We finally arrived at the out-of-the-way but very interesting city of Chilapa. For a day and a half we took a break from the routine by spending time in the marketplace, buying raspas, equivalent to our snow cones an Indian treat of crushed ice and syrup on a stick. The morning of our second day, a religious feastday, involved a great deal of fireworks, and historical street drama with local talent and an authentic Indian band with its blaring and banging repetitious accompaniment.

After the festivities we drove on looking for more bulb life. A *Tigridia* species in leaf and fruit, a spotted wide-leafed *Manfreda,* stoloniferous *Allium* and *Calochortus* in leaf grew under the pines at km. 71. An interesting find at km. 95 was a plant quite similar to *Milla biflora* but having approximately 2 mm. filaments in contrast to the usual 1 mm. or less. Search as we could, only three corms of this plant could be found.

Just beyond the village of Patatlan we saw growing up on a hillside what appeared to be a colony of *Bravoa geminiflora.* Instead we had seen an annual whose flowers bore a striking similarity both in color and form to those of the *Bravoa.* We gathered seeds and also dug *Hymenocallis choretis* which grew with the annual.

Soon after stopping to collect an interesting *Polypodium*-type fern and an *Oxalis* at km. 115, we drove through Chilapa back to Chilpancingo. Of note along this highway were several collections of *Sessilanthera latifolia* var. *heliantha* and perhaps a second species. From old flower stalks we could see that some had developed from out of the center of the fan of leaves and others from a point adjacent to the leaves.

The next day we drove south with Acaquizotla as our goal. In the summer of 1971 we had lost the opportunity of recollecting the indigenous *Petronymphe decora,* a plant in the *Milla* alliance with triangular leaves and an umbel of greenish, pendulant, tubular flowers. It prefers to grow high along rocky outcroppings near the village. On the route, we added more *Hymenocallis choretis* to the valuable load in the bus.

We first found a very hirsute Gesneriad with creme flowers spotted red. In addition we dug a few bulbs of *Hymenocallis eucharidifolia* which has become more difficult to find in the Acaquizotla area. For two hours we macheted and climbed through high vegation, first down to a creek bed, and then up the hillside to the rock ridge upon whose edge *Petronymphe* grew. By taking turns precariously balanced between rock and tree, we managed to knock loose a small collection, but a steep ravine with sides obscured by bush, kept us from reaching the main colony. This failure disappointed us considerably as the plant

has refused to set seeds under cultivation, and vegetative propagation is rather slow. At Chilpancingo we spent the night again.

South of Igula the next day we left the main road to Teloloapan. At the same location as last year we stopped to find the white *Sessilanthera, S. latifolia* var. *latifolia.*

At Km. 37 grew a rose-purple *Achimenes,* the large one-leaf *Begonia* sp., the leaf about two feet across. Another Gesneriad in the same location displayed its flowers to us on stems arising from tubers back in the cracks between rocks. This plant had light purple flowers with white centers spotted yellow. We returned to our cutoff and drove through Iguala toward Cuernavaca on the toll road.

The long, round drooping leaves of *Milla magnifica* at Km. 84 compelled us to pull off the road and upturn a few corms for the collection bag. In the plant-collecting spirit we started up another Microöndes around Km. 79. Both *Tigridia meleagris* and *T. ehrenbergii* were spotted on our way to the top.

MEXICO

We slept in Cernavaca and drove to Cuatla by noon the following day. At Km. 81 we passed from Morelos into the State of Mexico. Dr. Howard treated us to another excursion along breath-taking volcano side roads. He took us to the end of the roads leading to both Popocatepetl and Itzacihuvatl. Once again, the chilly air carried clouds across barren valleys at eye level.

In Mexico City we stayed long enough to enjoy supper and then drove to Queretero before calling it a day.

GUANAJUATO

At Km. 13 we passed the Queretero-Guanajuato state line on Highway 57. Still another Microöndes beckoned us at Km. 72. After an hour of driving and finally reaching higher altitudes we saw interesting plants again. Here were rock ferns, *Milla biflora,* wild *Zinnia,* and *Tagetes, Castilleja, Sprekelia, Allium glandulosum,* a yellow *Dahlia, Anthericam, Bomarea,* and a shrub with tubular yellow flowers. We also discovered *Tigridia ehrenbergii* whose sepals were larger and more yellow and whose center had more purple color than those of any of the species we had collected earlier. After a quick tour of the charming city of Guanajuato with its many underground highway tunnels we continued on into the State of Jalisco.

JALISCO

On our second pass through Jalisco, Dr. Howard planned to recollect a white *Polianthes* sp. which disease had destroyed in his garden. On the road to San Juan de los Lagos we scoured the ungrazed roadside along the fence for any signs of bloom. When this proved unsuccessful, a quick search on foot turned up the missing plant. Lack of rainfall had stunted the bloomstalk height and made the plants difficult to see. Thus, few plants were blooming, and we dug in the hard dirt guided mainly by the leaves. In association with the *Polianthes* grew *Milla biflora* in excellent form with many fragrant flowers per umbel.

SAN LUIS POTOSI

Our first collecting in San Luis Potosi progressed in unorthodox form. We had passed through Aguascalientes and were within 34 Km. of the City of San Luis Potosi, when Dr. Howard began peering into the peripheral light of the bus headlight for night-blooming *Milla clintii* he knew grew in the vicinity. A tiny patch of white in the darkness disclosed the flowers and we stopped, backed up, and dug corms of the *Milla* by headlight illumination. This one was *M. biflora* though. This same procedure finally resulted in a stop during which *M. clintii* was found. Beside it was an *Allium*, assumed to be *A. potosiense*. We tried every acceptable hotel and motel in the City of San Luis Potosi, but none had available rooms. Out of necessity we continued to Matahala where we found accomodations in the wee hours.

NUEVA LEON

In the comparatively cool and dry environment of Nuevo Leon we felt in our back yard. On a rocky hillside north of the State Line we found only one bulb, a *Milla* in leaf, but Steve took a specimen of *Mammilaria candida* for a cactus collection.

Allium neuvoleonense along with *Yucca, Agave, Mammilaria, Opuntia*, among the rocks appeared the Microöndes "Cruz de Elorza", Km. 27. Despite the sun and the dryness, the pleasant temperature of the breeze kept us comfortable.

Between Km. 66 and 67 we followed a dirt road to the right off the main highway. Dr. Howard's sharp eyes noticed bulb leaves in the bare spots among the shrubs and grasses, and the plant turned out to be *Zephyranthes* "Matahuela Frost" with ripened seed capsules. In the soft chalky soil we had soon gathered a sufficient number for the garden. Steve again demonstrated his powers of observation by noting a different *Allium* species, another plant previously collected by Dr. Howard and lost in cultivation.

Echeveria strictaflora, unlike most of this genus we had found chose a flat place to grow, namely along the roadside at Km. 92. Its colorful red and yellow flowers made it prominent along the bleak vegetation.

Another interesting find was a terrestrial orchid growing in this cactus environment. At Km. 112, Dr. Howard stumbled upon the red *Spiranthes* during a cursary investigation of one hillside.

We crossed the Nuevo Leon State Line into Coahuila to drive through Saltillo but soon returned to the former State at Km. 34. The final Microöndas of the trip left the highway as we did at Km. 36 or 37. When we stopped to collect *Allium ownbeyi* with its white and lavender flowers. Steve met up with a friendly little rattlesnake. Being a very shy individual, the snake only tried to hide in the rocks where he was perched above the road on a ledge and would not even shake his tail for us. *Echeveria simulans* was also found. At the TV tower at the top, the cool winds toyed with our balance in its powerful howling gusts. The view of the valley and mountains beyond was beautiful, and a rainbow in the distance added to the magnificence of the scene.

Despite the fact that the three of us traversed much of the countryside of the 1971 trip, we often came across a different variation of plant life because of the lateness of the summer and a few side trips. Steve discovered the interesting new *Bravoa* species. We collected *Sphenostigma longispathum*, a new plant for us. We brought back the few corms of the localized *Milla* sp. with 2 mm filaments. Dr. Howard relocated the Jalisco white *Polianthes* sp. and the Nuevo Leon *Allium* sp. And as usual, we saw the parts of Mexico few tourists visit, high up to dead volcanoes, into remote villages, and up TV tower roads. We look forward to enjoying this summer the fruits of our plant collecting in Mexico, 1972

MEXICAN PLANT COLLECTING TRIPS, 1973-1976

THAD M. HOWARD, *13310 San Pedro Avenue, San Antonio, Texas 78216*

1973 TRIP

Southern Mexico, Guatemala, and El Salvador were the focal points of my 1973 summer field trip. Jeff Fields, a college student accompanied and assisted me. As usual, luck seemed to be with me, and thus I was able to find several species of bulbous plants that may be new to science, as well as other rare things.

In the state of Oaxaca we collected a new *Polianthes*, tall and robust as a Tuberose, but with smaller flowers, slightly inflated in the tubular portion, light yellow within and with red exterior. Because of the inflated tubes, it appeared to be nearly intermediate between *Polianthes* and *Prochnyanthes*. The flowers are odorless and in cultivation they have sucessfully been hybridized with Tuberose.

A new *Hymenocallis* species was found in the mountains of Guerrero. This one flowers early, is fragrant and has linear leaves that are glaucous. It is a new addition to the Mexicana alliance.

A new *Allium* was found at the Hidalgo-Queretaro state line. It is a smallish thing, with pinkish-white flowers keeled purplish. Casually it is not too unlike our own Texas A. Drummondii, but closer inspection reveals that it is a member of the Mexicana *Allium* Alliance.

In Oaxaca I finally collected *Hymenocallis choretis* var. *oaxacensis* and was able to verify that it does indeed have shorter tubes (in some individuals) than the mainstream populations of this species found elsewhere.

1974 TRIP

The summer of 1974 gave me an opportunity to return to Oaxaca, by way of the Gulf Coast route via Veracruz. Jim Bauml accompanied me this time. The Veracruz area gave us a chance to collect *Crinum loddigesianum,* a plant I had previously mistaken for *C. americanum.* They are essentially very similar, but *C. loddigesianum* has slightly smaller flowers with much longer tubes, a slightly different fragrance, and occasonally a purplish tinge on the reverse.

In Oaxaca, near Huajuapan, I found yet another new *Polianthes*

species with red and yellow flowers. The flowers were not too unlike those we found in Oaxaca in a different environment the previous year, but these grew at a lower elevation in dryer conditions, had narrow, glaucous leaves, and were only half as tall. With the finding of this plant, we now have added three new species to the genus *Polianthes* in the state of Oaxaca, where previously none were known.

Another highlight in Oaxaca was the finding of *Crinum cruentum* in a large colony in the highlands on a hillside near a small stream. From a distance they looked somewhat like *Hymenocallis*, save that they were pinkish. At close range they look a good deal like *C. loddigesianum*, but more colorful. Whereas *C. loddigesianum's* habitat is the tropical coastal regions in aquatic conditions, the habitat of *C. cruentum* seems to be much higher elevations where moisture is more seasonal and it is dependent on runoff seepage during the rainy summer season. Apparently *C. cruentum* replaces *C. erubescens* in Mexico and reports of *C. erubescens* should propably be relegated to *C. cruentum*. *C. cruestum* differs from *C. erubescens* mainly in having much longer tepal tubes.

Jim Bauml spotted another new *Hymenocallis* species of the Mexicana alliance in the state of Mexico, near Amecameca, not far from the base of Popocatepetl, the famous snow-capped conical volcano. This one had a small staminal cup. It seems that nearly every new trip to Mexico adds yets another *Hymenocallis* species to our ever-enlarging collection. We now know of nearly thirty species from Mexico.

1975 TRIP

My 1975 trip was very different from all previous trips and I did a minimum of collecting. I drove from San Antonio to Chihuahua City, Chihuahua, and caught the train to the coastal region of Los Mochis and Topolobampo, Sonora. The train ride goes through Tarahumara Indian country and the famed Copper Canyon. I was pleasantly surprised to see many colonies of *Sprekelia formosissima* in leaf and in seed in the rocky outcroppings along the railroad high in pine tree country, at around 6000 feet or so. I think that this may be about as close as *Sprekelia* comes to our Southern U.S. borders . . . only a few hundred miles below New Mexico.

After leaving Chihuahua City and returning homeward, I collected a few *Zephyranthes longifolia* and *Manfreda brunnea*. Upon returning, I was able to plant and flower a few *Z. longifolia* bulbs and fulfill an old dream of hybridizing them with some of my own hybrids. I now have seedlings of *Z. longifolia* x 'Helen Wyatt' and look forward to see what weird sort of critters they will mature into.

I won't go into details of the 1972 trip since I understand Jim Bauml will do this elsewhere in the Yearbook, but I will mention that we collected an unknown member of the Manfreda-Polianthes tribe in leaf somewhere in Nayarit of Jalisco that finally flowered in the summer of 1975. It appears to be a new *Prochnyanthes* species. The flowers are reddish outside and light greenish-yellow inside. It differs from *P. mexicana* in having numerous, narrow leaves, not unlike many

Polianthes. It flowers here in early autumn. We also found a stunningly different *Polianthes* in the state of Colima with unpaired pendant tubular flowers produced in profusion on a tall scape. The exterior color is principally red and green, with a black interior. It has recently been published as *P. howardii*. Luther Bundrant has successfully hybridized *P. howardii* with *P. tuberosa* and these should flower early in the summer of 1977.

1976 TRIP

In 1976 Jim Bauml again accompanied me on two trips to Western Mexico (Durango, Sinaloa, Nayarit, Jalisco, Aguascalientes, and Zacatecas). I will write more of these two trips later, but we found more important collections of many species of *Polianthes*, *Allium scaposum* and other *Allium* species, *Hymenocallis leavenworthii* (formerly dubbed "*Pancratium*" *leavenworthii* in error), a new *Hymenocallis* closely allied to *H. acutifolia*, growing in a riverbed in Sinaloa, a new yellow flowered *Tigridia* from Sinaloa and Jalisco, plus our usual assortment of varied Mexican bulb life. For us, 1976 was a banner year, botanically speaking.

PLANT LIFE LIBRARY

COMPLETE BOOK OF HOUSE PLANTS UNDER LIGHTS, by Charles Marden Fitch. Hawthorne Books, Inc. 260 Madlson Ave., New York, NY 10016. 1975. Pp. viii + 275. Illus. $9.95. Hawthorne Books, Inc. has made a notable addition to their series of useful, "Complete" and "How to", books about plants. The publication of Charles Marden Fitch's, "Complete Book of Houseplants Under Lights" (CBHL) is a significant addition to this list. Produced under the capable direction of Helen Wilson Van Pelt as Editor, CBHL will be a valuable reference for both amateurs and professionals attempting to grow plants under lights. More specifically, CBHL is aimed at those persons wishing to grow plants under lights in their homes or in small greenhouses. CBHL is organized into two parts: Part 1, "Basics of light gardening" and Part 2, "Plants to grow". Under, "Basics of light gardening", such subjects are discussed as: Gardens under lights; Light in nature; Fixtures for light gardens; The environment: air, humidity, temperature; Containers and methods of watering; Potting mixes and fertilizers; etc. Part 2, "Plants to grow", is essentially a list of plants adapted to culture under lights. But it is much more than a simple list of plants. For example, the distance the plant is to be placed from the light source is given. Also, included is such relevant information as where the species originated, its habitat, method of propagation, a short description of the plant, and other pertinent and interesting facts. These highly condensed paragraphs about each genus are loaded with information, and are actually one of the most instructive and enjoyable features of the book. There is a chapter on pests and diseases, and a most useful and inclusive chapter on Plant Societies and Sources of equipment. The latter chapter also lists retail sources of plants suitable for growth under lights. The book terminates with a Bibliography of 10 entries, and an Index of 14½ pages. Fitch is one of those rare people competent to write a book of this nature. A skilled plantsman, a world traveler, an excellent photographer, and a writer with experience in popular and scientific journalism, it would be difficult indeed to find a person so well equipped to produce a **vade mecum** of high caliber on this subject. The book is abundantly illustrated, and the prose, clear and entertaining. I have no doubt CBHL wil prove to be a reference work of great value. There are few flaws in the composition of the book, although reproduction of the photographs does not do justice to Mr. Fitch's elegant photog-

raphy. There are surprisingly few typographical errors. The only major editorial error I could spot is the omission of the legends for the plants on page 175.— **Thomas W. Whitaker**

EDIBLE LEAVES OF THE TROPICS, by Franklin W. Martin and Ruth M. Ruberté. Published jointly by the Agency for International Development, Department of State, and the Agricultural Research Service, USDA. 1975 235 pp. illus. The authors of this "mine of information" are respectively, Director of the Mayaguez Institute of Tropical Agriculture and Laboratory Technician at the Institute, Dr. Martin has had seventeen years of experience in tropical agriculture, and is well known for his studies of edible and non-edible yams, and the genetics of incompatibility systems. His co-author is evidently knowledgeable in the field of biochemistry and nutrition. Their talents are merged beautifully to produce this important and original book of 235 pages.

In many ways the book is of great significance, mainly because it draws attention to the use of edible green leaves as food. Since edible green leaves are plentiful in the tropics, there is the potential of eliminating hunger and malnutrition over vast areas of the globe, providing people can be taught to exploit this resource. Plant scientists of temperate zones have little conception of the great number of tropical species with edible leaves. In the Appendix the authors have compiled, "A list of Tropical Plants with Edible Green Leaves." In this Table are listed approximately 1650 species scattered among 138 families—truly an incredible number. The authors have included much of their own research, but understandably they have derived much information from a thorough review of the literature.

One of the most important chapters in the book deals with, "Principal Edible Green Leaf Herbs of the Tropics" (Chapt. II). Here is a list of species with edible leaves segregated according to families. For each species the authors give much information of value, such as the parts of the plant eaten, notes on the history, culture, fertilization, and for some species preparation for the table.

In my opinion the authors have covered nearly every aspect of edible green leaves as the titles of the Chapters indicate. There are Chapters on "Some Fruits, Vegetables and Ornamental Plants with Edible Leaves"; "Common Weeds with Edible Green Leaves"; "Tropical Trees with Edible Green Leaves"; "Tropical Leaves as Spices and Teas"; "Temperate Zone Green Leaves in the Tropics"; and "Lettuce in the Tropics". The book concludes with and instructive Chapter on, "Tropical Leaves that are Poisonous"; and a useful Chapter on, "Culture and Care of Green-Leaved Vegetables".

Perhaps the weakest link in the book is the lack of nutritional information. This is by no means the fault of the authors. It simply indicates that here is one area of research where basic information needs to be developed.

There are some minor, but disturbing flaws in the book which gives one the impression that it was hastily assembled. One example is poor reproduction of the photographs. There are 56 photographs; few of them acceptably reproduced. Some are fuzzy, others lack sharp contrast, and have a washed out appearance. Some have both defects. A few are so poorly reproduced they do not adequately convey the author's message (Figure 38). There are the usual number of annoying typographical errors, and some awkward expressions. A more serious error is the misplacement of an entire paragraph. **Aleurites** species, and **A. fordii**, the source of tung oil are listed under the Compositeae. **Aleurites** is of course a genus of the Euphorbiaceae (pg. 99).

The reference to G. W. Purseglove's 4 volume work on Tropical Crops is improperly cited. One wonders why the book by G.A.C. Herklots, "Vegetables in South-East Asia" 1972, has not been cited in the Selected References Combining Edible and Poisonous Leaves. Herklots' book is

probably the most informative treatise on tropical vegetables yet published.

In summary, "Edible Leaves of the Tropics", is an extremely useful book for the purpose for which it was intended. It could easily have been an outstanding one with more attention to the details of typography, and printing. Let us hope the authors will make plans to correct the unnecessary mistakes that plague the text, in a second edition, which most surely will be demanded within a short period of time.—**Thomas W. Whitaker**

BIBLIOGRAPHY OF PLANT VIRUSES AND INDEX TO RSEARCH. Compiled and edited by Helen Purdy Beale. Columbia Univ. Press. 562 W. 113rd St., New York, N. Y. 10025. Pp. 1-xii - 1495. $75.00. This is a monumental work. After a little more than a page of acknowledgements and a very brief introduction explaining the preparation of the Bibliography and Indexes the remainder of the book is in two main divisions—the Bibliography covering 1452 pages, and Index To Research covering pages 1453-1495. Its purpose is "not only to make the large number of articles on plant viruses more easily obtainable for reference, but to make this information as readily available as possible." In the Introduction Dr. Beale states: "entries are arranged alphabetically according to author and make up the **author file**, exceeding 29,000 entries from an estimated 6,500 periodicals." About half of the articles are in English, the rest in various other languages. The Subject Index appears to be the most useful portion of the Bibliography. It is divided into two parts. Part I is a list of about 500 viruses with their reaction to 5 subjects of general interest, namely, (a) electron micrography; (b) indicator or test plants; (c) intranuclear bodies and virus-like inclusions; (d) purified viruses; and (e) serum reactions. Part II is compilation of references of each virus applied to those beginning with A thru C, and to some under D, G and T. The author admits the Bibliography is incomplete in some respects, but it is unlikely that any individual will have the expertise, experience and stamina to compile a better one for many years to come.

MYCOGENETICS, by J. H. Burnett. John Wiley & Sons, 605 3rd Av., New York City 10016. 1975. Pp. xiv + 375. Illus. Paper $12.00.—Subtitled **"An Introduction to the General Genetics of Fungi,"** this outstanding book will be welcomed as a pioneering volume in this little cultivated field. The book is in four sections. **Section 1** is concerned with fungi as organisms for genetic study. **Section 2,** the longest part deals with formal; genetics—genetic markers; recombination segregation and linkage; recombination and segregation of nuclei and extrachromosomal elements; and quantitative inheritance. **Part 3** is devoted to population genetics of fungi; and in **Part 4,** applications of fungal genetics are discussed. An appendix, bibliography, author and subject indices complete the volume. This land mark volume cannot be too highly praised, and is very highly recommended to mycologists, pathologists and industrial users of fungi.

A TREATISE ON LIMNOLOGY, VOL. III. LIMNOLOGICAL BOTANY, by G. Evelyn Hutchinson. John Wiley & Sons, 605 3rd Av., New York City 10016. 1975. Pp. x + 660. Illus.—This massive volume on the scientific study of fresh waters—ponds and lakes—is devoted exclusively to "botanical matters," covering conventional ecology of the higher plants and benthic algae, with as much ancillary matter as is needed to make the ecological presentation comprehensible. The six chapters are devoted to **the lower rooted vegetation;** the nature and diversity of **aquatic trachophytes;** biological characteristics of **Tracheophytes of inland waters;** the **chemical ecology** of freshwater macrophytes; the distribution of Macrophytes **in lakes;** and **the algal benthos.** A bibliography and index of authors; index of lakes; index of genera and species of organisms; and general index, complete the volume. Highly recommended to all interested in limnology.

WATER AND PLANTS, by Hans Meidner and David W. Sheriff. John Wiley & Sons, 605 3rd Av., New York City. 10016. 1976. Pp. x + 148. Illus. Paper $5.95.—Written for undergraduate students, this concise treatment of plant-water relations will be welcomed. **Chapter 1** deals with the proper-

ties of water, molecular, solvent, etc. **Chapter 2** is concerned with water vapor and the atmosphere. In **Chapters 3 and 4**, water movement through the plant, and water in soils, are discussed. **Chapter 5** is devoted to water in cells and tissues, and **Chapter 6** deals with the role of water in the plant as a whole. An appendix, a very brief bibliography, and index, complete the volume. Highly recommended.

UPTAKE OF IONS BY PLANT ROOTS, by D. J. Bowling. John Wiley & Sons, 605 3rd Av., New York City. 10016. 1976. Pp. xii + 212. Illus.—This attractive book updates our knowledge of mineral ion uptake by plant roots; tracing the uptake of salts by the root, movement of salts to the root surface, uptake into the root, transport across the root and movement in the xylem to the shoot. Highly recommended to post graduate research workers in the plant sciences and soil sciences.

METHODS IN PLANT ECOLOGY, edited by S. B. Chapman. John Wiley & Sons, 605 3rd Av., New York City. 10016. 1976. Pp. viii + 536. Illus. $29.50.—Although written primarily for undergraduate students, this attractive symposium volume should also appeal to research workers generally. Following the listing of the 14 authorities who contributed the articles to the symposium, and introduction, the remaining chapters deal with the History of Vegetation, Description and Analysis of Vegetation, Production Ecology and Nutrient Budgets, physiological ecology and Plant Nutrition, Site and Soils, Climatology and Environmental measurement, chemical analysis, and Data Collection Systems. An index completes the volume. Highly recommended.

ENVIRONMENT AND PLANT ECOLOGY, by J. R. Etherington. John Wiley & Sons, 605 3rd Av., New York City. 10016. 1975. Pp. xii + 347. Illus.—Written for the undergraduate student, this attractive book is concerned with (1) the aims and development of plant ecology; (2) energy exchange and production, (3) soils, (4) chemical and physical properties of soils, (5 & 6) plant and water deficit—physiological and ecological aspects, (7) waterlogged soils, (8) mineral nutrition, (9) biogeochemical cycling and ecology of mineral nutrition, and (10) competition. A bibliography and index complete the volume. Highly recommended.

PLANTS: AN INTRODUCTION TO MODERN BOTANY, 3RD EDITION, by Victor A. Greulach and J. Edison Adams. John Wiley & Sons, 605 3rd Av., New York City. 10016. 1976. Pp. xii + 586. Illus. $13.50—This attractively made 3rd Edition of a standard text in plant science has been written for one-semester or one-quarter courses in general botany. The material is presented in six parts. **Part 1** is built around the theme of man's dependence on plants; the uses of plants by man—foods, raw materials for industry, textiles and cordage, medicines, insectocides, fuels, etc. **Part 2** Plant Classification is almost two decades behind the times. The argument made that groupings of living things are not necessarily natural does not hold for the primary subdivision of **procaryotes** and **eucaryotes** (cellular organisms without or with nuclei) is so fundamental that all research workers proceed on that basis and the student should start out with this fundamental conception **so that he will not be shocked when he reads scientific articles.** Since there are three types of **Eucaryotes—**Plantae, Heteroplantae (fungi) and animals, all with similar cells containing nuclei, the text is in fact concerned with **Procaryotes** (bacteria and Blue Green Algae), **Plants** and **Fungi** (both with the eucaruotic cellular organization; and omitting Animalia, with a similar cellular structure which would be included in a text on Biology (see Traub, 1963, 1964, 1971, 1975). The rest of the section is concerned with plants of the past. **Part 3** is concerned with the levels of plant organization—atomic, molecular, tissue and organ. **Part 4** deals with plants in action—absorption of nutrients, photosynthetic activity, transportation and use of organic substances in growth, etc., water relations of plants; and plant development. **Part 5** is concerned with the plant in its physical environment, other organisms, and the plant community as a whole. **Part 6** deals with plant reproduction,

asexual and sexual; plant genetics, heredity and evolution. An appendix, a glossary and index complete the volume. Recommended to beginning students in plant science . (Literature cited: Traub, Hamilton P.—**Plant Life** 19: 160. 1963; **Lineagics.** 1964; **Plant Life** 27: 141-144. 1971; **Taxon** 24: 293-295. 1975); **Plant Life 33:** 85-104. 1977.

STRASBURGER'S TEXTBOOK OF BOTANY, by D. von Denffer, W. Schumacher, K. Maegdefrau & F. Ehrendorfer. **New English Edition** by Peter Bell and David Coombe. Longmans, 19 West 44th St., New York, N. Y. 10036. 1976. Pp. xvi + 877. Illus. $25.00. This English translation of the newest revision of Strasburger's classic text on plant biology, including **for the first time** a Part on the general principles of plant systemematics and evolution (lineagics) by four outstanding German and Austrian plant scientists, will be welcomed by all. The book begins with an all too short Chronology from c. 300 B. C. (Theophrastus) to 1957, which is followed by a brief introduction on the living state. origin of life, animals and plants, and the divisions of plant biology. The main text is in four parts—**Morphology, Physiology, Systematics** and **Evolution (Lineagics)** and **Plant Geography. Part One—Morphology** deals with cytology, morphological organization, plant tissues, morphology and anatomy of the plant body, and its modifications, and reproduction. **Part Two—Physiology** is concerned with metabolism, growth and movement. **Part Three—Systematics and Evolution (Lineagics),** is devoted to the general principles and a survey of the Plant Kingdom. Although the general principles concerning the **primary** distinctions in plant life, the **procaryotic** and **eucaryotic** cellular organization, are mentioned incidentally in the text, this fundamental fact is not carried over into the organization of the text. A wrong impression is created when Division I. **Schizophyta** (=Kingdom I. **Procaryotae**) is given equal rank with Divisions **Phycophyta (algae), Mycophyta** (fungi), **Bryophyta** and **Spermophyta** (subdivisions in Kingdom II **Eucaryotae).** Thus, a key showing these true relationships, made clear by recent recognition of the fundamental facts of cellular organization, bacteria, plants, fungi and animals, is needed for clarification. Plant biology has to be considered as a part of biology as a whole. **Part Four. Plant Geography,** is concerned with distribution patterns and their causes; plant commutities; history of the flora and vegetation; and floristics. There is an appendix concerning the fossil plant record, and a bibliography of selected references arranged by text divisions. A subject index completes the text. Highly recommended to students of plant biology.—**Hamilton P. Traub**

PLANT PATHOSYSTEMS, by Raoul A. Robinson. Springer-Verlag New York, 175 5th Av., New York, N. Y. 10010. 1976. Pp. 184. Illus. $19.70. Aimed mainly at the young scientist in plant protection and breeding who is looking for a new conceptional framework on which to orient his future career, and also to the more mature student, this book is concerned with plant pathosystems; vertical pathosystems analysis, and management; horizontal pathosystem analysis and management; polyphyletic pathosystems; crop vulnerability, and conclusions. A chapter on terminology, a bibliography and index complete the volume. Recommended to students and workers in the field of plant pathology.

FENNOSCANDIAN TUNDRA ECOSYSTEMS. PART 2. ANIMALS AND SYSTEMS ANALYSIS, edited by F. E. Wielgoliski. Springer-Verlag New York, 175 5th Av., New York, N. Y. 10010. 1975. Pp. 337. Illus. $57.00. This is part 2 of a **symposium** on the Fennoscandian Tundra Ecosystems and is concerned with research on productivity (cardon energy flows and nutrient cycling) and synthesis of these ecosystems.

RESIDUE REVIEWS: RESIDUES OF PESTICIDES AND OTHER CONTAMINANTS IN THE TOTAL ENVIRONMENT, edited by Francis A. and Jane Davis Gunther. Vols. **57** (1975), **58** (1975), **59** (1975), **62** (1976). $16.80 per volume. Springer-Verlag New York, 175 5th Av., New York, N. Y. 10010. $16.80 per volume.—In these four volumes contributions on the residue or other contaminants are published in the order in which they

are received and the mass of information is indispensible to all who are concerned with problems caused by the use of pesticides, particularly those engaged in the production, storage, marketing, regulation and consumption of foodstuffs.

TREES AND MAN, by Herbert L. Edlin. Columbia University Press, 562 W. 113th St., New York City. 10025. 1976. Pp. xvi + 269. Illus. $25.00.—The author considers world wide forests from the viewpoint of conservation, an outlook that first took shape in the early 20th century. **Part 1** is concerned with the life cycle of trees; woody stem and its function, buds, shoots, leaves and roots; and reproduction. **Part 2** deals with forest ecology, and forest conservation. **Part 3** is devoted to the various kinds of forest trees, and **Part 4** is concerned with the raising of trees, for ornament; in agriculture, fruit and nut trees; for timber, and wood from trees; and trees as sources of sugar, rubber, resin, cork and chemicals. An index completes the volume. This instructive and delightful book is recommended highly to all interested in trees.

THE FOREST WORLD OF NEW ZEALAND, by J. H. Johns and C. G. R. Chavasse. Imported by Charles E. Tuttle Co., Rutland, Vermont 05701. 1975. Pp. 156. Illus. $23.95.—This wonderful book is profusely illustrated (no less than 64 illustrations), often in full color. The subject is concerned mainly with the forest and mountain landscape treated **"with a freshness and depth of feeling that will strike a chord in the hearts of all. . . ."** While the trees and mountain scenery are the main features, herbaceous plants, orchids, Fuschia, etc. are also shown. In addition, some of the spiders, insects (butterfly), frogs, reptiles, colorful birds, particularly the blue mountain duck and black swans, mammals (introduced deer and wild horses), are also pictured. The short text is somewhat disappointing. This outstandingly beautiful book cannot be too highly praised, and is recommended to all readers.

AUSTRALIAN EUCALYPTS, by Douglas Baglin and Barbara Mullins. Imported by Charles E. Tuttle Co., Rutland, Vermont 05701. 1966. Pp. 32. Illus. Paper.—This profusely illustrated pamphlet is concerned with 80 Australian Eucalyptus tree studies (all in full color), with notes on characteristics, uses, propagation, cultivation and pest control. Highly recommended to all readers.

THE SEEDLIST HANDBOOK (SECOND EDITION), by Bernard E. Harkness. Kashong Publications, Box 90, Bellona, New York 14415. 1976. Pp. 216. Paper, $5.00.—The purpose of this enlarged second edition is to furnish a guide to seed selection from the seed lists of the American Rock Garden Society, the Alpine Garden Society, and the Scottish Rock Garden Club. The literature references are keyed from 1 through 97, and at least one or more sources for more information are indicated for each of the plants listed alphabetically from **Abelia** through **Zygophullum** species. Highly recommended to all interested gardeners.

PRACTICAL INSECT PEST MANAGEMENT, by Theo. F. Mason, Leon Moore, and George W. Ware. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1976. Pp. xvi + 196. Illus. Paper, $5.95. Subtitled **"A Self-Instruction Manual"**, this book has been written for specialists in pest control, advanced high school students, federal and state officials, and concerned citizens. The five sections of the manual are concerned with the **Nature** and **Basic Elements** of insect pest control; the components of **Insect Pest Management;** insect pest management by means of **microbes, pheromones, chemosterilants** and **insect growth regulators;** and **implementing** insect pest programs. Recommended to all interested in insect pest control.

HIGH-YIELDING RICE CULTIVATION, by Seizo Matsushima. International Scholarly Book Services, P. O. Box 555, Forest Grove, Oregon 97116. 1976. Pp. ix + 367. Illus. $32.50. Subtitled **A Method for Maximizing**

Rice Yield through "Ideal Plants" (=ideal growth response) as contrasted with past recommendations to increase yield by improving soil conditions. His criteria for determining yield as a basis for "ideal rice plants" (=ideal growth responses) are the number of panicles per unit area, the average number of grains per panicle, the percentage of ripened grains and weight of 1.000 grains. On this basis be studied various factors in obtaining maximum yields. Recommended to those interested in rice growing.

THE VEGETATION SURVEY OF WESTERN AUSTRALIA: THE VEGETATION OF THE MULLARBOR AREA, by J. S. Beard. International Scholarly Book Services, P. O. Box 555, Forest Grove, Oregon 97116. 1975. Pp. viii + 104. Illus. including Vegetation Survey Map. $12.50. The survey is concerned with the vegetation of the Mullarbor Area of Western Australia—the natural regions, climate, geology, physiography, soils, human and animal influences, and the detailed description of the vegetation. A bibliography completes the volume. Recommended to all interested in the vegetation of Australia.

FASSETT'S SPRING FLORA OF WISCONSIN, 4th Edition revised and enlarged by Olive S. Thomson. University of Wisconsin Press, Box 1379, Madison, Wisc. 53701. 1976. Pp. ix + 413.—Fassett's classic manual, subtitled "A Manual of Plants Growing without cultivation and Flowering before June 15", 4th revised and enlarged edition by Olive S. Thomson will be welcomed. It contains over 100 new illustrations, and takes into account the changing distribution of species, and the introduction of new species into the state. Following the introduction, there follows a **key to the families,** the descriptive **Spring Flora** (pp. 23—379). A Glossary, Selected References, and an Index complete the volume. Very Highly recommended.

GUIDE TO THE VASCULAR FLORA OF ILLINOIS, by Robert H. Mohlenbrock. Southern Illinois University Press, P. O. Box 3697, Carbondale, Ill. 62901. 1975. Pp. xii + 494. Illus. $12.95.—This new Flora of Illinois will be welcomed. After a discussion of the **Natural Divisions of Illinois,** there follow the **GENERAL KEY TO GROUPS OF ILLINOIS VASCULAR PLANTS;** and the **DESCRIPTIVE FLORA** including **2,699 species, 265 lesser taxa and 83 hybrids** in Illinois. The entry for **Hymenocallis** (p. 184) should be reconsidered on the basis of specimens in the Missouri Botanical Garden. Highly recommended.

LIGHT AND PLANT DEVELOPMENT, edited by H. Smith. Butterworths U. S. A., 19 Cummings Park, Woburn, Mass. 01801. 1976. Pp. 516. Illus. $35.00.—This symposium volume of the 22nd University of Nottingham (England) Easter School in Agricultural Science (Apr. 7—10, 1975) is dedicated to the late Dr. H. A. Borthwick, and to Dr. S. B. Hendricks, pioneers in the field of photomorphogenesis. The symposium by outstanding authorities is presented under six heads: **I**—Light perception; **II**—the site of phytochrome action; **III**—Cellular Aspects; **IV**—Physiological Aspects of phytochrome Action; **V**—Photoperiodism, Endogeneous Rythms and Phytochrome, and **VI**—Ecological Aspects of Photomorphogenesis. A **list** of participants in the symposium and an **index** complete the volume. Very highly recommended to all interested in plants.

SMITHSONIAN CONTRIBUTIONS TO BOTANY. In this numbered serial publication the Institution publishes original monographs dealing with various plant groups. These may be obtained from Smithsonian Institution Press, Washington, D. C. 20402.

No. 23. FLORA OF THE MARQUESAS, 1: ERICACEAE—CONVOLVULACEAE, by Marie-Helene Sachet. Pp. 34. 1975. Brief introduction and taxonomic treatment with keys, synonymy, description, distribution of the families from **Ericaceae** to **Convolvulaceae**.

No. 25. REVISION OF THE LICHEN GENUS HYPOTRACHYNA (PARMELIACEAE) IN TROPICAL AMERICA by Mason E. Hale, Jr. Pp. 88. 1975. Includes revision of 77 "species" occurring in tropical America; 58 endemic to the New World.

No. 27. THE MOSSES OF JUAN FERNANDEZ ISLANDS, by Harold Robinson. Pp. 88. 1975. Keys and descriptions of 129 species, 73 genera and 32 families; 32 species recognized as endemic; four new combinations.

No. 29. A STUDY OF THE TRIBE GESNERIACEAE WITH A REVISION OF GESNERIA (GESNERIACEAE: GESNERIOIDES), by Laurence E. Skog. Pp. 182, 86 figures, 9 tables. 1976. A study of the tribe Gesnerieae, Family Gesneriaceae from the West Indies, with information on the history, anatomy, karketing, pollination, dispersal, hybridization in the tribe; and the taxonomy.

No. 30. A REVISION OF AMERICAN VELLOZIACEAE, by Lyman B. Smith and Edward S. Ayensu. Pp. 172, frontispiece, 53 figures, 37 plates. 1976. Systematics of 4 genera and 229 species of American Velloziaceae is brought up-to-date; with introduction, taxonomic keys, synonyms and species distribution.

No. 31. A MONOGRAPH OF THE LICHEN GENUS PSEUDOPARMELIA LYNGE (PARMELIACEAE), by Mason E. Hale, Jr. Pp. 62, 18 figures. 1976. A World monograph of the Genus Pseudoparmelia, with 76 species. New species are described, new combinations made.

No. 33. A MONOGRAPH OF THE LICHEN GENUS PARMELINA HALE (PARMELIACEAE) by Mason E Hale, Jr. Pp. 60, 21 figures. 1976. The species of Parmelina are revised on a World level.

No. 34. NEW RECORDS OF MARINE ALGAE FROM THE 1974 R/V DOLPHIN CRUISE TO THE GULF OF CALIFORNIA, by James E. Norris and Katina E. Bucher. Pp. 22, 13 figures. 1976. Six species of benthic marine algae, one of Chlorophyta, two Phaeophyta, and three Rhodophyta, are newly reported from the Gulf of California. Species of Halicysitis, Sporochnus, Bonnemaisonia, Dudresnya and Sebdenia represent new genera to the Gulf, the last being new to North America.

NO. 35. THE GENUS COLPOMENIA DERBERS ET SOLUER (PHAEOPHYTA) IN THE GULF OF CALIFORNIA, by Michael J. Wynne and James N. Norris. Pp. 18, 11 figures. 1976. Four new species of the brown algal genus Colpomenia are recognized as occurring in the Gulf of California.

AQUATIC BOTANY, VOL. 1 (NOS. 1-4). This timely new periodical was launched by Elsevier Scientific Publishing Co., P. O. Box 211, Amsterdam, Netherlands as a quarterly in 1975. It deals with the fundamental and applied phases of research of submerged and floating plants in marine and fresh water ecosystems. The journal will serve as an outlet for papers on the consequences of the disturbance of aquatic ecosystems, including transplantation of aquatic plants, influence of herbicides and other chemicals; termal pollution, biological control methods grazing and diseases; the use of aquatic plants; conservation of resources and the aspects of production and decomposition of aquatic plants. In this age when the conservation of our aquatic resources is an important goal, this journal will surely be welcomed, and we wish for it all possible success.—Hamilton P. Traub

FROM SINGLE CELLS TO PLANTS, by E. Thomas and M. R. Davey. Springer-Verlag, New York, 175 Fifth Av., New York, N. Y. 10010. 1975. Pp. xv + 170. Illus. $7.20. This timely book on plant tissue culture will be welcomed. The authors begin with a brief history of tissue culture (Chapter 1). Chapter 2 is devoted to the basic materials and methods; Chapter 3 deals with the culture of plant organs; Chapter 4, with the culture of plant cells; Chapter 5, with higher plant protoplasts, their isolation and behavior; Chapter 6, with morphogenesis in cell cultures; Chapter 7, with the culture of haploid reproductive cells, and Chapter 8, with plant tissue culture. An appendix, taxonomic and subject indices, and a bibliography for further reading, complete the book. Highly recommended.

PLANT PATHOGENESIS, by Harry Wheeler. Springer-Verlag New York, 175 5th Av., New York, N. Y. 10010. 1975. Pp. 106. Illus. $16.00.

Intended as a text for advanced undergraduates and graduate students in plant science, this text deals with mechanisms of pathogenesis, plant responses to pathogens, disease resistence mechanisms, genetics of pathogenesis and the nature of the physiological syndrome. A bibliography and index complete the volume. Recommended to students of plant pathology.

SUNSET BOOKS PUBLISHED IN 1976. All edited by Editors of Sunset Magazine and Sunset Books. These may be obtained from Lane Publishing Co., Menlo Park, Calif. 94025.

SUNSET WESTERN GARDEN BOOK. Pp. 448. Profusely illustrated. $5.95. This is a mine of information and a great bargain. It begins with the description of the West's 24 climate Zones, including maps. The text is in two parts. HOW TO GROW PLANTS, soils and planting mixtures through to garden maintenance. **PLANT SELECTION GUIDE;** basic and special landscaping; situations; garden color; special effects, and problem areas; **GARDENERS' LANGUAGE (GLOSSARY);** and **WESTERN PLANT ENCYCLOPEDIA** of more than 175 pages, giving brief descriptions and cultural notes for more than 5,000 plants, arranged alphabetically by botanical names, common names also given. An INDEX to general subject matter completes this outstanding book, which every western gardener should own and have handly for ready reference. This outstanding book cannot be too highly recommended.

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INTERCELLULAR COMMUNICATION IN PLANTS: STUDIES ON PLASMODESMATA, edited by B. E. S. Gunning and A. W. Robards. Springer-Verlag, New York, 175 5th Av., New York City. 10010. 1976. Pp. xiv + 387. Illus. $29.60. It is to be noted that 1961 marks the beginning of a new phase in the history of plasmodesmata. This important book on that subject is a symposium, including the editors among the authors of some of the 15 review chapters which deal with analogues of plasmodesmata; their presence in higher plants, algae and fungi and origin and development; plasmodesmatal transport; evidence of intercellular communication; viruses and plasmodesmata; transport of solutes, water and nutrients; and their role in growth and development. A bibliography, author and subject indices complete this outstanding volume. Very highly recommended to all interested in plant physiology.

PROGRESS IN BOTANY 37, edited by H. Ellenberg, K. Esser, H. Merxmueller, E. Schneff, and H. Ziegler. Springer-Verlag New York, 175 5th Av., New York City, 10010 1975. Pp. xvii + 402. Illus. $49.20. This 37th in the series is in the nature of a timely symposion, including reviews by competent authorities in the fields of **morphology, physiology, genetics,** taxonomy, and geobotany. The literature is cited following each review, and a general subject index completes the volume. Highly recommended.

PLANT LIFE LIBRARY—continued on page 30.

BESCHORNEREA YUCCOIDES C. Koch

HAMILTON P. TRAUB

In the 1950's Mrs. Clint Morris of Brownsville, Texas, sent sn
plants of *Beschornerea yuccoides* C. Koch, which had been collected
Mexico. Later in the early 1970's, when the writer distributed se
of this fine plant, Mrs. Clint had forgotten about the gift she had ma

This is a most satisfactory member of the Order *Agavales*. It d
not die after flowering as is the case with *Agave* species. The flow
is red, marked with green, and the plant makes a fine showing ea
season without fail.

This brief note is inserted to make known *the name of the speci*
which had not been determined when the seeds were sent out. As ind
cated above, the name is *Beschornerea yuccoides* C. Koch [Voehensc
ii(1859) 337; iii(1860) 63; vi(1864) 186.]. Attention is directed to th
note about this plant in *The Garden* (Jour. Roy. Hort. Soc. 101(5)
279. 1976) by John Newall, Ringwood, Hampshire, England: "Th
main parent plant [he apparently means stalk] dies after flowering and
produces from the base a number of young plants which can be separated
or left to grow into a large clump. I feel that separation will make
better and more graceful single plants which will flower in two years."

THE AMERICAN PLANT LIFE SOCIETY

For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

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[A Committee of the American Plant Life Society]

[AMERICAN AMARYLLIS SOCIETY, continued from page 6.]

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This is required reading for every amaryllid enthusiast.

2. **DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893—1948**, by Norton, Stuntz, and Ballard. A total of 2695 Hemerocallis clones are included and also an interesting foreword, and explanatory section about naming daylilies. Manila covers; 100 pages (1—X; 1—90), includes a portrait of George Yeld. $5.00 postpaid.

3. THE GENERA OF AMARYLLIDACEAE, by Hamilton P. Traub. Includes a general introduction, a key to the subfamilies, infrafamilies, tribes, subtribes and genera of the Amaryllidaceae, and descriptions of all the genera. Every member of the Society should have this book for constant reference. Manila covers; publ. 1963; 85 pages. $8.00 postpaid.

4. LINEAGICS, by Hamilton P. Traub. This is the first outline text for the undergraduate student on the grouping of organisms into lineages. The text is divided into four parts: (a) the history of lineagics and lineagics as an integrated science; (b) basic lineagics, principles and procedures; (c) applied lineagics, principles and procedures; and (d) research methods in lineagics. Recommended for the student in biology. Publ. 194. Manila covers, 163 pages, incl. 8 illus. $8.00 postpaid.

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PLANT LIFE

AMARYLLIS YEAR BOOK

1978

Nerine laticoma (Ker.- Gawl.) Dur. & Schinz
Native to South Africa

THE AMERICAN PLANT LIFE SOCIETY

THE AMERICAN PLANT LIFE SOCIETY is organized for the "increase and diffusion of knowledge concerning plant life," and to carry out its objectives the main emphasis is placed on the publication of PLANT LIFE, the periodical devoted to plant life, incl. HERBERTIA, the yearbook devoted exclusively to the amaryllids, sponsored by the affiliated AMERICAN AMARYLLIS SOCIETY. The publications are international in scope. All paid up members are privileged to receive the current issues of PLANT LIFE, incl. HERBERTIA, THE AMARYLLIS YEARBOOK.

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All editorial correspondence should be addressed to: Dr. Hamilton P. Traub, *Editor, The American Plant Life Society, 2678 Prestwick Court, La Jolla, Calif. 92037.*

All persons and organizations interested in amaryllids, and other plants are invited to become members. The annual dues vary from (domestic $7.00 to $8.00; (foreign, $8.00 to $9.00) depending on the publishing costs. At present they are (domestic $7.00); (foreign $8.00) in advance which should be sent to:

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PLANT LIFE

VOLUME 34

[Nos. 1-4, Jan., Apr., Jul. & Oct.]

1978

EDITED BY

HAMILTON P. TRAUB

R. MITCHEL BEAUCHAMP

HAROLD N. MOLDENKE

THOMAS W. WHITAKER

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The cover design by Prof. Penrith B. Goff pictures **Nerine laticoma** (Ker-Gawl.) Dur. & Schinz which is native to South Africa. It is well worth cultivating out of doors in Southern California, and may be grown as a pot plant farther north.

PLANT LIFE, VOLUME 34, NO. 1, 1978—AMARYLLIS YEAR BOOK
GENERAL AMARYLLID EDITION

PLANT LIFE, VOLUME 34, NOS. 2—4, INCL., 1978
GENERAL EDITION

ILLUSTRATIONS

PLANT LIFE, VOL. 34, NO. 1, January, 1978

AMARYLLIS YEAR BOOK 1978

Year Book of

The American Amaryllis Society

44th Issue

GENERAL AMARYLLID EDITION

EDITED BY

HAMILTON P. TRAUB

R. MITCHEL BEAUCHAMP

HAROLD N. MOLDENKE

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THE AMERICAN PLANT LIFE SOCIETY
Box 150, La Jolla, California 92038

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For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

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Box 150, La Jolla, Calif. 92038

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(**AMERICAN AMARYLLIS SOCIETY**, continued on page 129.)

PREFACE

We are indebted to Prof. Penrith B. Goff for the cover design which pictures *Nerine laticoma* (Ker-Gawl.) Dur. & Schinz, native to South Africa. This interesting species can be grown outdoors in southern California and farther north as a pot-plant indoors. (See *Review of the Genus Nerine*, Appendix to PLANT LIFE Vol. 23. 1967.)

This 45th issue of the American Amaryllis Year Book is dedicated to Dr. Walter S. Flory, Jr., the outstanding authority on the caryology (chromosomes) of the Amaryllidaceae. This subject has interested him since 1937 and he and his collaborators have contributed regularly to a better understanding of the caryology of the Amaryllidaceae over a period of four decades. The award of the William Herbert Medal to him in 1978 was therefore long overdue. Dr. Flory presents an interesting autobiography, a bibliography of his contributions to a knowledge of the caryology of the Amaryllidaceae, and the known geographical distribution and chromosome numbers of the species of *Hymenocallis*.

We are happy to announce that Randell K. Bennett, an outstanding Amaryllidarian has been appointed Chairman of the General Amaryllid Section. It is his function to consider the Amaryllids as a whole, and to fill in the details about the various genera, including particularly those neglected so far and in this manner to present a more complete coverage of the Amaryllis Family. The members should note his first General Amaryllid Report and the article on the control of leafhoppers on amaryllids, below.

There are interesting articles on *Amaryllis* in the present issue: Amaryllis breeding potentials by Dr. William D. Bell; the role of *Amaryllis* species in commercial hybrids by Dr. Cage; a step towards a yellow *Amaryllis* hybrid by R. E. Tisch; breeding double *Amaryllis* by John Wade Deme, and *Amaryllis* culture by E. M. Beckham.

Dr. Howard contributes an article on new *Hymenocallis* species from Mexico.

Randell K. Bennett gives his first report as Chairman of the Amaryllid Committee; Mrs. Marcia C. Wilson presents the 1977 Zephyrantheae Report; Donald D. Duncan contributes the Alstroemeria Committee Report, and Mr. Zuidgeest gives his first Nerine Committee Report from Holland.

Prof. Pierfelice Ravenna contributes two outstanding articles—one on South American Amaryllids, and the other on Allieae of South America.

James E. Shields writes on growing Amaryllids in the Midwest; Richard E. Tisch on *Pancratium maritimum;* W. Roger Fesmire returns as a contributor with an interesting article on Amaryllids on a dry hillside; and Randell K. Bennett writes about leafhoppers on Amaryllids.

There are reports on the 1977 Amaryllis Exhibitions, and other articles as indicated in the Table of contents.

Contributors to the 1979 issue of the AMARYLLIS YEAR BOOK are requested to send their articles by August 1, 1978, in order to insure

earlier publication of this edition. Unless articles are received on time, publication will again be delayed to June or July or even later as with some issues in the past. Your cooperation toward earlier publication will be greatly appreciated. *Those having color slides or transparencies which they wish to use as the basis of illustrations are requested to have black-and-white prints made, and to submit these with their articles.*

January 15, 1978,
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Hamilton P. Traub
R. Mitchel Beauchamp
Thomas W. Whitaker, Harold N. Moldenke

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LIPIDS AND LIPID POLYMERS IN HIGHER PLANTS, edited by M. Tevini and H. K. Lichtenthaler. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1977. Pp. xiv + 306. Illus. $41.40.—The papers included in this volume were presented at a symposium held in 1976 at the Botanical Institute of the University of Karlsrube. The symposium was organized in five sections—(1) function, organization and lipid composition biomembranes, (2) physiology and biochemistry of fatty acids and glycerides; (3) physiology and biochemistry of plant steriods; (4) physiology and biochemistry of prenyllipids, and (5) lipid polymers in higher plants. Literature references and a subject index complete the volume. Highly recommended.

BIOLOGICAL INSECT PEST SUPPRESSION, by Harry C. Coppel and James W. Mertins. Springer-Verlag New York, 175 Fifth Av., New York City, 1977. Pp. xiii + 314. Illus. $29.60.—The text is arranged in five parts: (1) glossary, (2) historical, theoretical and philosophical bases of biological insect pest suppression; (3) organisms used in classical biological insect pest suppression; (4) manipulation of the biological environment for insect suppression, and (5) a fusion of ideas. Literature references and an index complete the volume. Highly recommended.

POLLINATION MECHANISMS, REPRODUCTION AND PLANT BREEDING, by R. Frankel and E. Galup. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1977. Pp. xi + 281. Illus. $26.40.—The objective of this book is to furnish under one cover an integrated botanical, genetical and breeding-methodological treatment of the reproductive biology of spermophytes, mainly angiosperms which is based on an advanced topical course in plant breeding as taught at the Hebrew University of Jerusalem. Highly recommended.

38—PROGRESS IN BOTANY, edited by H. Ellenberg, K. Esser, H. Merxmueller, E. Schnepf and H. Ziegler. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1976. Pp. xvi + 377. Illus. $49.20.—This international symposium is partly in the English and German languages. The articles are arranged under four headings: (1) Morphology; (2) Physiology; (3) Genetics; (4) Taxonomy and (5) Geobotany. A subject index completes the volume. Highly recommended.

SACRED NARCOTIC PLANTS OF THE NEW WORLD INDIANS, by Hedwig Schleiffer. Hafner Press, 866 3rd Av., New York City 10022. 1974. Pp. v + 156. Illus. $5.95.—Subtitled "an anthology of texts from the 16th century to date", this compilation is presented with introductory words by R. E. Schultes. After the anthology on the narcotic complex, anthologies are presented for the Mushroom Family, Cactus Family, etc. Indices of Latin names of plants, and plant products, complete the volume.

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DEDICATED TO

DR. WALTER S. FLORY, JR.

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TRANSPORT IN PLANTS III - INTRACELLULAR INTERACTIONS AND TRANSPORT PROCESSES, edited by C. R. Stocking and U. Heber. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1976. Pp. xxii + 517. Illus. $59.50.—The purpose of this volume is to bring together in one book a critical evaluation of the published results on intercellular transport solutes scattered through the literature. The text is arranged in four parts: (1) membrane structure; (2) intracellular reactions, (3) intracellular transport in relation to energy conversion, and (4) theory of membrane transport. Lists of symbols, and references, and author and subject indices, complete the volume. Highly recommended.

PLANT GROWTH REGULATION, edited by P. E. Pilet. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1977. Pp. xi + 305. Illus. $28.20.—These reports on plant growth substances were presented at the 9th International Conference on Plant Growth Substances, at Lausanne in 1976. The subjects covered include the walls of growing cells; hormones—membranes; hormone analysis; auxins and root growth inhibitors; gibberellins and cytokinins; ethylene and other regulators; gravity and light effects; hormonal control, and paper demonstrations. A subject index completes the volume. Highly recommended.

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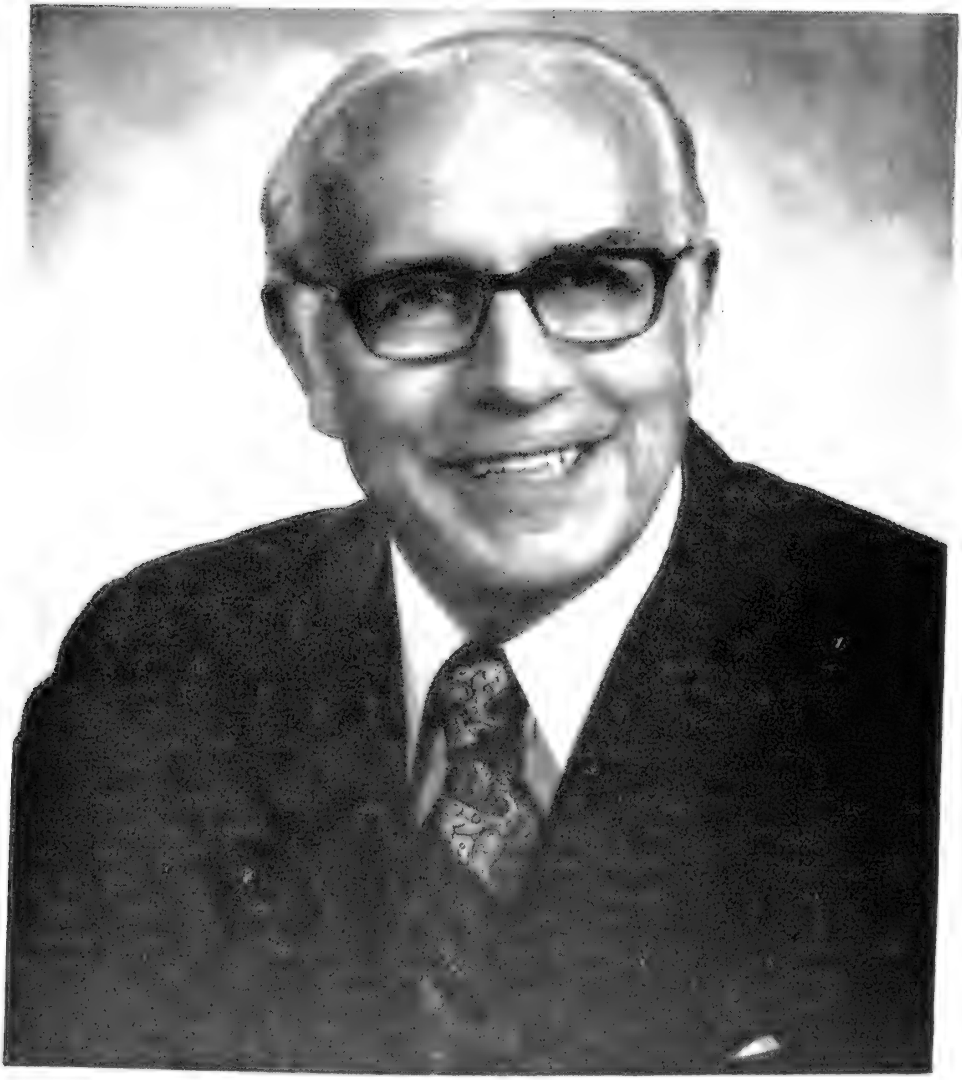

DR. WALTER S. FLORY, JR.—HERBERT MEDALIST

WALTER S. FLORY, JR.

An Autobiography

Born in Bridgewater, Virginia, October 5, 1907, the first 20 years of my life were essentially spent in this small town where my elementary, secondary and college education was received. In 1928 the B.A. degree was received from Bridgewater College, with a double major—in chemistry and in foreign languages (German and French). My parents Ella May Reherd Flory and Walter S. Flory were both very much interested in plants and also in education and educational work. Prior to marriage my mother taught in elementary schools for several years, but she was aways much interested in a variety of yard, garden, and house plants. My father was born on a farm, worked a farm for a few years, and retained and directed the same farm during his lifetime. After receiving the B.A. degree from the University of Nashville (now the George Peabody College for Teachers) in 1892, he also taught school—being a high school principal for some years, served as a railroad mail clerk for a while, and became involved as a stockholder in several business ventures. Although my parents moved to a small college town shortly before my birth, my father—as well as Mother—was always an ardent gardener. As a consequence of parental interests my attention was directed to the raising of animals (cattle, horses, swine, chickens, etc.) and more especially of plants from the time of my earliest recollections.

Upon graduation from college I was offered, and accepted, a DuPont graduate research fellowship in biology at the University of Virginia. Although the fellowship was under the direction of the well-known plant geneticist, botanist and collector- Professor Orland Emile White, during my first year in graduate school I worked most closely with the invertebrate zoologist Professor William A. Kepner. My thesis for the Master's degree, received in 1929, dealt with a description of the male reproductive system of a small flatworm (Turbellarian), *Gyratrix*, and was published in 1930 in the Transactions of the American Microscopical Society.

In the spring of 1929 I began studies in plant genetics and cytology under the direction of Professor O. E. White at The Blandy Experimental Farm, a 700-acre farm and genetics experimental laboratory belonging to the University of Virginia. My studies dealt chiefly with the genetics of sexuality in garden asparagus, and with the cytogenetics of several taxa in the *Phlox* family. The Ph.D was received from Virginia in 1931, my dissertation being titled "Genetic and Cytological Investigations on *Asparagus officinalis* L." This was published in Genetics (Volume 17: 432-467, 1932). Papers dealing with studies on *Phlox*, and other members of the Polemoniaceae, were published in 1931, 1934, 1935, 1937, 1947 and 1971.

Here it should be stated that on April 24, 1930, Nellie Maude Thomas of Bruceton Mills, West Virginia, and I were married. I had

met this charming young lady almost 6 years earlier when we were freshmen in college, and we had a good 41 years together until her untimely death in 1971.

My career took a rather sharp—but short-lived—turn in 1931 when I accepted the position "In Charge of Technical Work" with Shaver Brothers, Inc.—at that time the largest citrus processing company in Florida—with plants in Jacksonville and Tampa. Here my combined chemical and botanical background proved useful. At night, during this period, I studied law—by correspondence with the Blackwood Institute of Chicago. But the winter of 1931-32 was a "black" one for Florida. Shaver Brothers, Inc. was one of the many companies that went into bankruptcy that winter. My chief employer, however, was the president of other processing companies which survived, and for short periods I worked with a pimento processing plant at Wayside, Georgia, and later as a tomato buyer for the Hazelhurst Canning Company in Mississippi.

At this point it was decided that I really wasn't going to "make my first million" in business, and that an academic career looked more attractive than a business one. In the fall of 1932 school positions were much in demand and decidedly scarce. By real luck I obtained a position as Instructor in Mathematics and Chemistry at Greenbrier (Junior) College in Lewisburg, West Virginia, where I remained until the fall of 1934. The pay was negligible, but the town (elevation about 2300 feet), its people, and the surrounding area as a botanical hunting ground were unexcelled. A most pleasant two years were spent in Lewisburg. In 1934 my Alma Mater—Bridgewater College—offered me the position of Professor, and Chairman, of its Biology Department. Accordingly, after three years absence from my native state, I was again back in my own home town.

This second stay in Bridgewater was short. I applied for one of the 30 National Research Fellowships offered by The National Research Council for 1935-36, and was fortunate in being awarded one. Professors E. M. East and Karl Sax of the Bussey Institution and the Arnold Arboretum of Harvard University were agreeable to my working under their direction and in their laboratories during the tenure of the fellowship. At that time East and Sax were at the pinnacle of the genetic hierarchy, and Sax was one of the outstanding men in the world in the relatively new science of Cytogenetics. To work in their laboratories was an envied opportunity, and the training received and contacts made in the year 1935-36 played an important part in the future direction of my career. It may be added that in order for me to use the Harvard Laboratories, I was also appointed a Research Associate of Harvard University.

In the early part of 1936, both Drs. East and Sax received requests from the Texas Agricultural Experiment Station to offer recommendations for someone qualified and trained in genetics to fill a newly created position involving the breeding of horticultural plants especially adapted to Texas. My two mentors were good enough to suggest me for the position, and during the years 1936-44 I served as a Horticulturist of the

Texas Experiment Station at College Station, Texas, as well as a professor on the graduate faculty of Texas A&M College (now University). In this capacity, working under auspices of the federal Bankhead-Jones Act, I had active breeding projects with cabbage (and later with broccoli and with southern peas), with plums, and with certain ornamentals—especially oaks, and roses, but also with oleanders, the Madagascar periwinkle, etc.

None of the plants worked with in my regular projects had chromosomes large enough or unusual enough to furnish particularly interesting cytological material. In my free time I started looking at the chromosomes of some of the native liliaceous and amaryllidaceous taxa. First I looked at the chromosomes of a liliaceous plant very prevalent in Brazos County and all of eastern Texas—the poison camas *(Zigadenus Nuttallii)*—but these—unlike the chromosomes of many taxa of this family—proved to be quite small, also regular, and unexciting. Next I studied several local members of the Zephyrantheae, including *Habranthus texanus* Herb. ex Steud. (2n=24) as well as *Cooperia Drummondii* Herb. and *C. pedunculata* Herb. which were both found to have 48 somatic chromosomes. Also, I collected and studied cytologically *Hymenocallis galvestonensis* (Herb.) Baker and the plant later described by Shinners as *H. Eulae*. The former was usually found by wet roadsides and ditches and in swampy areas, flowered in the early spring soon after sending up leaves, and proved to have 40 somatic chromosomes all of which had interstitial centromeres. *Hymenocallis Eulae* Shinners grew in drier locations, often in deep friable soils, and flowered following late summer rains, long after its leaves had withered and dried. This latter species proved to have a 2n chromosome number of 52, 40 of which were metacentric, and 12 telocentric. The finding of telocentric chromosomes in one of the first two *Hymenocallis* taxa studied proved the forerunner of knowledge concerning a phenomenon (fission of metacentric chromosomes at the centromere to produce 2 telocentrics in place of 1 metacentric—an example of the so-called Robertsonian Law) which is fairly common in the genus, and which quite apparently has played a considerable role in the evolution of *Hymenocallis* (Flory, 1976).

At College Station, Texas, I lived on the Agricultural Experiment Station Horticulture Farm for a number of years. In the spring of the year the park-like area which surrounded the residences on the Farm abounded with the Copper Rain Lily, then usually termed *Zephyranthes texana* (but which was really *Habranthus texanus*), as well as with the fragrant white-flowered *Cooperia Drummondii* Herbert. One spring a great many buds of the Copper Rain Lily were emasculated, and bagged to prevent stigma contamination with unknown pollen. These plants were pollinated at the proper time with pollen coming from various species of *Habranthus*, *Zephyranthes* and *Cooperia*. To my delight practically all pollinations resulted in good sets and copious amounts of seed. All were carefully planted and tenderly cared for over the several years necessary to bring the resulting bulbs to flowering size. To

my dismay all my "hybrids" turned out to be maternals exactly like the seed parent, the Copper Rain Lily. Some of this work was discussed in my first two papers on *Habranthus* which appeared in *Herbertia* in 1938 and 1939. The explanation was found in some earlier work of Lula Pace's of Baylor University who had found, while working in Strasburger's laboratory in Germany, that in the Copper Rain Lily eggs were formed with unreduced chromosome numbers. When pollination occurred, the two "polar" nuclei in the embryo sac which had previously fused were now united with one of the sperm nuclei. This fertilization resulted in the development of the triploid endosperm, but the egg nucleus was not fertilized. However, as the endosperm grew it furnished nourishment for the unreduced eggs which were now able to grow and develop—without fertilization—into seeds. But the two sets of chromosomes in these seeds had both come from the seed plant. No hybridization occurred. As a result plants from these seed were Copper Rain Lillies—just like the seed plants producing them.

Almost exactly eight years after arriving in Texas, I accepted a position as Horticulturist, in Charge of Fruit Research, with the Virginia Agricultural Experiment Station at Blacksburg, Virginia. My wife and I had arrived in Texas in 1936 with most of our worldly possessions in the rather large trunk of a Ford coupe. Eight years later we left with two young "Texans" and the accumulation of furniture, books, toys, bicycles, etc., common to growing families. The opportunities for research and growth which had been afforded me by such men as A. B. Conner and Paul C. Mangesdorf, Director and Vice-Director of the Texas Station, respectively, were unexcelled. We had formed many close friendships—a number of which still exist 30-odd years later. And we left the Lone Star State with a real love and appreciation for Texas and its wonderful people.

During the three years spent at the Virginia Station two adjacent farms were purchased for the Experiment Station which gave it an excellent several hundred acre tract of good horticultural land and most of which had a very desirable gentle slope toward the Roanoke River Valley. During the three years following purchase, this land was all contoured and was then planted with the best prevailing varieties of apples, peaches, nectarines, grapes, blueberries, blackberries and some other fruits. A collection of all the East Malling dwarfing apple stocks was assembled. Extensive new breeding programs with practically all deciduous fruits were developed, some built on previous work at that station. Test plots for new hybrids were set up in several of the different fruit areas of Virginia. In other words, the three years spent at the Virginia Station were very busy ones, and little time was available for attention to my recently found interest with the Amaryllids.

I was 36 years of age when the move to Blacksburg was made. Favorable research conditions in Texas had resulted in a goodly number of publications under my name, and others followed at V.P.I. The depression was over, the Great War easing its tension, and schools were expanding rapidly. Doubtless due to this combination of circumstances

I found my services in demand as at no other period in my life. Chairmanships of the Horticulture Departments of two large western land grant universities were offered me. A prominent southern state University urged me to accept the chairmanship of its Botany Department. The USDA approached me concerning my interest in a research position with ornamental plants, and a little later the USDA made me a firm offer to become Division Head of their nationwide breeding and cultural work with grapes. One of the good Virginia colleges inquired if I would be interested in having my name considered for its vacant presidency. The Virginia Station countered each such approach by improving my position at Blacksburg, where the location and job were much to our liking. It was during these Blacksburg years that our youngest son was born.

In 1947, however—three years after returning to Virginia from Texas—a new position set up by the University of Virginia was offered me, and accepted. This position was that of Professor of Experimental Horticulture, affiliated with the University of Virginia's Department of Biology, and in addition carried the titles of Vice-Director, and Manager, of the Blandy Experimental Farm—the 700-acre genetic set-up developed for the University of Virginia by Orland E. White. This was the same set-up under which both Dr. Thomas W. Whitaker, Executive Secretary of The American Plant Life Society, and I had worked and received our Ph.D. degrees under the direction of Professor White. Later, in 1955, another title was added to my Virginia position—when I was named Curator of the Orland E. White Research Arboretum, upon the retirement of Dr. White. The Arboretum covered about 130 acres of the Blandy Experimental Farm, contained many species of exotic trees and shrubs (including an excellent collection of conifers) and was located on some of the most fertile soil and in one of the most scenic spots of the beautiful Shenandoah Valley. Newly acquired exotic plants and collections were added to the Arboretum each year.

In the position with the University of Virginia—at the Blandy Experimental Farm—the opportunity presented itself for me to return to my interests with certain members of the Amaryllis family. Almost at once efforts were initiated to secure bulbs of as many different species of the family as possible, with chief efforts being directed toward getting together collections of *Zephyranthes* and their relatives, and of *Hymenocallis*; but species of many other genera were also assembled.

Several different students carried out studies on some of these amaryllids to be reported in the dissertations which they presented and had accepted as one of the requirements for the Ph.D. degree from the University of Virginia. Dr. Thelma Ficker Schmidhauser made a general survey of chromosome numbers, and their likely taxonomic significance, in the Amaryllidaceae. Dr. Smritomoy Bose carried out a careful cytological survey of most of the species of *Lycoris*, and also studied both native and cultivated *Sprekelia* collections in depth. Dr. Raymond Flagg made an exhaustive study of several genera in Tribe Zephyrantheae. All of these works resulted in published contributions throwing con-

siderable light on important biosystematic problems existing in these groups of plants. Several publications appeared in *Herbertia* or in *Plant Life*. During the same period I was studying *Hymenocallis* in as much depth as possible, and was also spending considerable time on research with *Zephyranthes* and its relatives. In addition, I had other doctoral students carrying out biosystematic studies of such plant groups as the conifers, the Araceae (Philodendrons and relatives), the Convolvulaceae (Morning-Glory family), the genus *Rosa*, etc.

When I left Texas and returned to Virginia in 1944 I felt as if I were returning home and fully expected to spend the remainder of my life in my home state. Quite unexpectedly a fork in this straight road arose presenting a choice of direction—in the summer of 1962. Dr. Elton C. Cocke, then Chairman of the Biology Department at Wake Forest College, and a man whom many years before I had known well during graduate school days, called and made an appointment to come to my office to talk concerning a position at Wake Forest. It was thought that Professor Cocke was probably interested in some, or some one, of my former students as potential Assistant Professors for Wake Forest, although I was a little surprised that he would travel 300 miles for that purpose. But when Dr. Cocke arrived he described a new endowed professorship—the Babcock Chair of Botany—which had just been established at Wake Forest. Dr. Paul Sears (author of "Deserts on the March" and other well-known books) had just retired as Professor of Botany at Yale University and had accepted the new professorship at Wake Forest for one year only, 1962-63. The job was being offered me, beginning in the fall of 1963. The first reaction of both myself and of my wife was that we had no interest in leaving the pleasant area where we lived, the circle of friends who had become closer as 16 years had passed, the association with the prestigious University of Virginia, and perhaps most especially to leave the state where I was born, had worked so long, which I greatly loved, and which had treated us so well.

Later in the autumn of 1962 Professor Cocke invited me to visit the Wake Forest Biology Department, and to present a seminar before its staff and graduate students. The invitation was accepted, and we were impressed by the new campus and buildings—first used in 1956—of this school which had been founded in 1834 more than a hundred miles to the east. Even more impressive was the young and enthusiastic group of faculty members which Professor Cocke had assembled. But returning home we were still "Virginians," and had little thought of making a change. Additional correspondence and calls kept the position and its possibilities prominently in mind, however. Finally we began thinking that a change of scene, to a beautiful small city such as Winston-Salem certainly is, working with a strong young faculty, and the opportunity to help develop a "Master's" graduate program into a doctoral one, might be stimulating and bring a new enthusiasm into a career with not too many years to run. The result was that the new position was accepted in February 1963, and plans were underway to secure a home in

Winston-Salem so that we might move in August, before the start of school in September.

This move proved advantageous in most ways. As Chairman of a new Departmental Committee directed to develop a doctoral program, such a program was outlined, planned, approved by the Biology Department, and steered through the Graduate Committee, the Graduate Faculty, the various Administrative Offices, and to final approval by the Board of Trustees in 1969. This was the first departmental doctoral program offered on the Wake Forest (now University) Reynolda Campus (although the Ph.D. degree was being offered by several departments in the Medical School on the Hawthorne Road campus). In 1973 I had the honor of "hooding" Dr. Lorraine B. Spencer and Dr. Francis F. Willingham, as the first two to receive Ph.D. degrees on the Wake Forest Reynolda Campus. Both were my students. Dr. Spencer had written a monograph of the *Zephyranthes* of North and Central America. Dr. Willingham had studied the *Rhododendron calendulaceum* complex in the Blue Ridge mountains. Both were excellent pieces of work. Our Department of Biology has had a number of additional doctoral students in recent years. One of the outstanding recent ones has been Dr. Dwight Kincaid, a student of mine - working with an intricate problem in hollies *(Ilex)*. Receiving his Ph.D. in 1976, Dr. Kincaid is currently Cabot Postdoctroral Research Fellow at Harvard University. A current student, Mrs. Carolyn Strout, is developing as her doctoral research cytological studies of several groups, including as many *Nothoscordum* species as are available.

One advantage of the new position has been the additional time offered for research. I was assured I would never have more than one class per term, and that this would be either a graduate course, or a senior course. This amount of teaching, with small classes, has presented time in which several long-standing Amaryllid projects of mine could be finished. This is attested to, to some extent, by the list of appended publications - with the great majority of those written since 1963 dealing with some Amaryllid group or problem.

Trips to Study and Collect Certain Amaryllidaceous Taxa

Many of the *Hymenocallis* species and Zephyrantheae taxa comprising a chief interest of mine in the Amaryllidaceae are distributed, roughly, through the land areas in or not too far removed from the Gulf of Mexico. Efforts to see, learn, study and/or collect as many of these - especially those north of South America - as possible will now be described. Such efforts have resulted in several trips to various of the southern United States, as well as to Mexico and the West Indies. They have also stimulated work-visits to most of the larger and a number of the smaller herbaria in the United States. In addition several European herbaria have been visited: sometimes in quest of a single type species; to study some of the earlier collected specimens of a plant group; to go over recently accessioned specimens of interest; to confer with inter-

ested curators; etc. Hundreds of amaryllidaceous specimens have been borrowed (occasionally twice, or even several times) from American and foreign herbaria. As these efforts have comprised an important - as well as most interesting - part of studies with representatives of the Amaryllis family, a brief account of the more noteworthy of these follows. The list of those persons to whom I am deeply indebted for aid in various ways, at different institutions and places, is much too long to be included here. A few persons are mentioned, at pertinent places, as especially helpful contributors to the studies.

Although I had spent about two weeks in the Mexico City area in 1940, travelling through the 3 or 4 states around the Federal District, it was not until June of 1952 that I made my first real collecting trip into Mexico. At that time several weeks were spent in the states of Guerrero, Hidalgo, Mexico, Morelos and Puebla; bulbs of several *Hymenocallis* and *Zephyranthes* taxa, as well as of *Sprekelia,* were collected and air-mailed to Virginia through the Hoboken inspection station. Return from Mexico on that 1952 trip was through Cuba, via Yucatan. In Cuba several days were spent searching for *H. praticola* Britton & Wilson in the Provinces of Santa Clara and Las Villas, the original collection sites of that species. However, the weather was dry and unfavorable for flowering and no plants of the desired species were located.

In June of 1954 about a week was spent in the herbarium at Kew Gardens, London - going over the *Zephyranthes* and *Hymenocallis* specimens there. Mr. John Sealy of that institution was interested in both genera and has published excellent accounts of both. As a result there were numerous specimens of these genera in the Kew Herbarium and all were in good shape and well annotated. A short time was also spent in the British Museum Herbarium. The Kew Herbarium, and also the American collection in the British Museum Herbarium, were revisited in late August of 1954, after spending a number of weeks on the continent. Herbaria in Copenhagen, Amsterdam, Stockholm, Zurich and Florence were also searched for specimens of both genera.

On the first day of October, 1954, I flew to San Antonio, Texas, where I met Bruce Cornwell, a friend from the University of Wisconsin. Bruce was not an Amaryllid enthusiast, but he was fond of Mexico, was an expert photographer and a most congenial companion and "aide." After meeting me at the San Antonio airport, Bruce stopped his station wagon at the first supermarket encountered and we stocked up on a good supply of staple foods. Following this, we drove south to Cotulla, Texas (where Lyndon Johnson had taught school for a time), and spent the night preparatory to entering Mexico early the next morning. It should be stated that we both carried sleeping bags. Bruce had a Coleman gas stove, several Army surplus 5-gallon gasoline cans - with spigots welded into the base - to be used as water containers, and other equipment suitable for camping. Most of the month of October was spent in Mexico searching for bulbs, chiefly of *Zephyranthes* and of *Hymenocallis.* When suitable sleeping and eating accommodations were available we used them; when not - we slept in the mountains and cooked our own food.

Our Mexican route traversed roads leading through, or in a few cases barely touching, the states of Tamaulipas, Nuevo Leon, Coahuila, San Luis Potosi, Jalisco, Colima, Michoacan, Mexico, Queretaro, Morelos, Puebla and Hidalgo. The approximate extreme points of our trip were Guadalajara and Uruapan to the west and Puebla to the south. Three nights were spent in the mountains, one of these in a thundering rain. While it was disappointingly dry during the first days, later it was overly wet as Hurricane Hazel swept across the Mexican Plateau. These were not conditions favoring collecting. We did come up with a number of collections of *Zephyranthes* - most of them in the *Z. lindleyana-Z. clintae* complex. While disappointed in the number of *Hymenocallis* taxa seen and collected - later study revealed that we had secured *H. choretis* Hemsley var. *choretis* Traub (from a barranca west of Cuernavaca; 2n=42); *H. choretis* var. *oahacensis* Traub (from south of Puebla; 2n=84); *H. harrisiana* (from near Puebla; mostly 2n=84; some 2n=86); *H. eucharidifolia* Baker (from near Jacala. State of Hidalgo; 2n=44); *H. acutifolia* (Herb.) Sweet (from cultivation in Cuidad Victoria; 2n=46); *H. mexicana* (from the states of both Michoacan and San Luis Potosi; 2n=46); as well as other not certainly identified collections from near the towns of Antigua Morelos (Taumalipas), Jacala (Hidalgo), and Tamazunchala (near the border of the states of Hidalgo and San Luis Potosi). Upon returning to the United States, through Brownsville, we had the fortunate experience of meeting the Morris Clints with whom a lively correspondence concerning common plant interests had been carried on for several years. This 1954 experience was the beginning of an enduring friendship with kind and knowledgeable people who have done much to expand my knowledge of many Amaryllids, as well as of other plants.

In June 1956 I travelled southward on a combined vacation-collecting trip with my family. The trip led to Key West, with a week spent in Dade County, Florida, returning. It also included a short trip by air to the Bahamas. West of Homestead, Florida, and also on one of the Keys, my first *Hymenocallis Palmeri* plants were seen growing, and bulbs of these collected. In the Everglades bulbs of *Crinum americanum* were secured. *Hymenocallis latifolia* was prevalent on several of the Keys and collections were made on both Boca Chica and Biscayne Keys; in both collections, 2n=46. On New Providence Island two collections were made of *H. arenicola*. Bulbs from the beach at Nassau had 50 somatic chromosomes; while a second collection of *H. arenicola* from a Nassau church yard proved to have 52 somatic chromosomes.

A collecting trip into Mexico with Mr. and Mrs. Morris Clint was made in late June and early July of 1957. While interesting, most enjoyable and profitable, the trip was abortive to a certain extent because

of mechanical problems. I flew to Brownsville, Texas, where I was met at the airport by the Clints who were driving a new, air-conditioned car - secured in anticipation of our trip. The night was spent with the Clints in Brownsville, and the next morning we crossed the border, drove to the city of Victoria for lunch, and in the early afternoon were proceeding southward toward El Mante. The new car gradually developed a rumbling sound, which made it seem advisable to stop and hitch-hike a ride into El Mante for aid. The DeSoto agency in that city kindly sent out a wrecker to tow us into El Mante, where it was determined that a defective drive-shaft was involved. This part was not available in El Mante, nor in Mexico City, and had to be ordered from Detroit. This meant a complete replanning of our trip. Some ten days were spent with a pleasant motel in El Mante as headquarters. Arrangements were made with a local taxi driver, Senor Rodriguez Guerrero, who picked us up early each morning - along with four lunches packed by the Motel "cuisine." Each day we went out in a different direction searching for plants, and while our original plans were drastically changed we were able to cover much territory, see many interesting plants, and collect a fair number of bulbs - especially of *Zephyranthes.* A ten-day period under such unexpected circumstances reveals the real character of all concerned. At the end of the trip I was more convinced than ever of the knowledgeability, kindliness, and unexcelled worth of the fine couple with whom I travelled.

In April, 1960, accompanied by my colleague and former student, Dr. Ray Flagg, a collecting trip in Florida and Georgia was undertaken. While southern trips during April had been taken over a period of years - especially to attend meetings at various places of the Association of Southeastern Biologists with some plant collecting along the way - the 1960 trip was made with the sole intent to study Florida *Zephyranthes*, as well as to locate and collect as many *Hymenocallis* as possible. *Zephyranthes atamasco* (L.) Herb. and *Z. treatiae* S. Wats. were found in great profusion at numerous places. Our studies of these, both in nature on the trip and later on collected plants carried back to Virginia, convinced us that these two taxa were really just different physiological forms of one and the same species. If growing in wet places the bulbs proliferated more and usually produced somewhat more vigorous and larger flowers and wider leaves. If growing in relatively dry pine woods, the opposite was true. But both had identical chromosomes, crossed readily reciprocally, and the progeny were indistinguishable in appearance and behavior. *Zephyranthes Simpsonii* Chapman was also seen in profusion. Usually this species is only found south of an imaginary east-west line passing near Bradenton, Florida. We were surprised to find our first specimens of the species in Alachua County, just a short distance out of Gainesville, Florida. But the plants at this point had likely been brought in with ballast used for roadside fills. This latter species, *Z. Simpsonii,* is readily distinguished from *Z.*

atamasco by its more trumpet-shaped flower (with less reflexed tepals) and also by having its filaments contained in the tube. Cytologically, *Z. Simpsonii* has 48 somatic chromosomes - just twice the number found in *Z. atamasco.*

We encountered a number of *Hymenocallis* on this trip, several of them occurring and flowering in rivers. In order to collect bulbs of these one sometimes had to follow a stem down through six or more feet of water and dig the bulb from the muck on the bottom of the river. My 1976 paper on *Hymenocallis* lists (Table 2) the various 1960 Florida and Georgia collections of this genus. Several other short collecting trips to southeastern states followed during the early 1960's.

Late May and early June of 1961 were again spent in Mexico. Dr. Ray Flagg, Research Associate at the University of Virginia, and I flew to Brownsville, Texas. From there we accompanied Mr. and Mrs. Morris Clint, Sr., on a trip which took us first to the state of Vera Cruz. Several days were spent with a comfortable motel in a lush tropical setting at Fortin de les Flores as our headquarters. This was near the base of snow-capped Orizaba, North America's second highest mountain. From here we travelled out in various directions by car, or by train from nearby Cordoba. Trains ran down toward the Isthmus of Tehuantepec, and collections were made along the Rio Blanca, the "River of 7 Waters," and along other rivers. *Cooperia miradorensis* Kranz was seen in great profusion through the state of Vera Cruz, and proved to be a true *Zephyranthes* or member of the Euzephyranthes, as we had concluded it probably was - following an earlier study of its type specimen from the Universisty of Copenhagen.

The 1961 Mexican trip also involved visits to the states of Puebla, Jalisco, Nayarit, Guanojuato, Neuvo Leon, Coahuila, Michoacan, Mexico, Tlaxcala, San Luis Potosi, and perhaps one or two other Mexican states. We returned with a total of about 520 bulbs, belonging to some 10 or 11 genera, plus seed of still other taxa. Altogether it was a most profiitable trip. A number of the taxa had been collected and described earlier by Mrs. Clint. Information on other collections has been, or in some cases still remains to be, described in other articlees.

Much of the month of May, 1964 was spent collecting in the West Indies, especially in Puerto Rico, St. Croix in the Virgin Islands, and in Jamaica. Exit, and re-entry, from and to the United States was through Miami, where my former student, Dr. Robert J. Knight, Geneticist with the U. S. Plant Introduction Division in Miami, greatly facilitated the inspection of the bulbs I had collected. So that this account not become too long, I will only say that the trip was most productive, and that bulbs of most West Indian *Zephyranthes*, and of many *Hymenocallis* of the area were secured. The week of collecting in Jamaica was an especially good one because of the extensive aid of Mr. George

Proctor, Botanist for the Institute of Jamaica (in Kingston), and the easy pin-pointing of collection sites by examination of herbarium specimens and records at the Institute.

In August of 1964 the Tenth International Congress of Botany held in Edinburgh, Scotland, was participated in. The specimens of Amaryllidaceae in the Herbarium of The Royal Botanical Garden at Edinburgh were gone over in detail. Later in the month visits were made to the Universities of Oxford and of Cambridge, and to their gardens and herbaria, and again almost a week was spent in the Kew Herbarium. This was followed by a long anticipated visit to the University of Coimbra, in Coimbra, Portugal, where Professor Abilio Fernandes—who has done so much to clarify the cytological problems involving *Narcissus* and its many horticultural hybrids—was a most friendly and generous host. In a way *Narcissus* is an old world counterpart of *Zephyranthes,* the former being distributed around the Mediterranean while the latter is chiefly present in the islands of, and the countries surrounding the Caribbean. It was a delight to have the opportunity to again see and visit with Professor Fernandes (first met at the Botanical Congress in Paris in 1954) and to see the excellent facilities and the fine staff and work he had developed at a University which was flourishing before Columbus discovered America.

The Kew Herbarium was visited again for five days in 1968, en route to participating in a Seminar on "The Chromosome—Its Structure and Function" being held in Calcutta, and following that to the XI International Congress of Genetics in Tokyo. At both the Calcutta and Tokyo meetings reports were made on new chromosomes (unlike those of any of the parental lines) which were found in complex interspecific and intergeneric hybrids involving different genera and species of Tribe Zephyrantheae. Professor C. Pavan, of the University of Sao Paulo, had found similar phenomena in intergeneric hybrids with certain insects—his suggested explanation being that cytoplasmic effects were likely responsible for the observed changes in chromosome types. This is one phase of cytological investigation, in connection with "wide" hybrids in the Amaryllidaceae, offering a seemingly great potential of interesting and valuable information.

During the early years at Wake Forest (the mid and late sixties) specimens of Zephyrantheae and of *Hymenocallis* were again borrowed (as had been the case while at Virginia) from a number of different herbaria for careful study. On several occasions visits were made to the National Herbarium in Washington and to the Herbarium of the New York Botanical Garden, and to various state herbaria as the opportunities for this occurred. Gradually a feeling of greater familiarity

with the genera of my chief interest has seemed to help clear various questionable points—but many ambiguous points remain.

In 1976 I was again invited to take part in an International Seminar organized by Professor A. K. Sharma and held in Calcutta. This Seminar was attended in October 1976, the general topic being "Chromosomes in Evolution." This presented the opportunity to summarize some of the chromosome work carried out with over 20 genera, in 10 Tribes of the Amaryllidaceae, by myself, students and colleagues over a period of years. The title of my 1976 lecture in Calcutta was "An Overview of Chromosome Evolution in the Amaryllidaceae," a paper expected to appear shortly in the Proceedings Volume of that Seminar.

After 10 days in India, in October 1976, a week was spent in London—most of which time was again spent in studying the specimens of *Zephyranthes* and of *Hymenocallis* in the Herbaria at Kew and at the British Museum. This was my fifth, and probably most profitable, visit to these herbaria.

A Final Word

The years spent in biosystematic studies of certain of the Amaryllidaceae have been interesting, and from my standpoint most profitable. One of the great pleasures involved has been the acquaintanceships—many ripening into real friendships—with many other persons interested in the same or related plants. Most plantsmen, I have found, are generous to a fault—in their offers to share material, information and enthusiam. In many cases such plantsmen when in possession of as many as two bulbs of a rare taxon—are glad to give one of these to a fellow enthusiast. The list of such persons who have aided me is much too long to list here, but such a list would be topped by such people as Kitty Clint, and the late Morris Clint; their daughter, Marcia C. Wilson; Hamilton P. Traub; Raymond O. Flagg; and the late Len Woelfle—to mention just a few. A recent collaborator, Padre Julio Cicero, S. J., of the Dominican Republic, must be acknowledged for his generous help. Padre Cicero has supplied bulbs of rare Zephyrantheae species and hybrids native to his country or resulting from personal crosses. He has also sent bulbs of *Hymenocallis* from his Republic, along with valuable information concerning distribution of the taxa furnished. Botanists, both professionals and amateurs and from many states and many places have shared materials, bulbs, experiences and interests. It is the pleasant association with such people and their work, and also certainly with a group of able and interested student-friends (from whom I have learned a great deal) that would cause me to follow the same path, if a life-trek were to be chosen again.

This account would not be complete without acknowledging the interest, aid, stimulus and "green-thumb" help of my wife Gale Crews Flory, who among other things has efficiently taken over the cultural care of my Amaryllid collections during the past few years.

Finally, one of the profitable satisfactions accompanying plant study has been the constant opening up of new problems, as is true—I am sure—of any scholarly pursuit. One study may seemingly be completed, answering the original question in mind. But at the same time that study usually brings several new questions—as to relationships, origins, possible hybridizations, evolutionary pathways, etc., to mind. It is the interest involved in theorizing as to possible answers, and of how such problems may feasibly be solved which keeps one feeling young, though aging in body—and which makes life an ever more interesting phenomenon.

SPECIAL ACKNOWLEDGMENTS

The stimulation, skill, and vision of Dr. Hamilton P. Traub's personal work, as well as his encouragement to me, as to all Amaryllid lovers, is gratefully acknowledged. His 'brain child'—*The American Plant Life Society*—has done much to forward knowledge concerning many facets and taxa of the Amaryllidaceae, and to account for our present understanding of this family. For financial assistance of various types I am indebted to the National Science Foundation (Grants B3296, G11080 and GB1767), the Virginia Academy of Science, the Wake Forest University Research and Publication Fund, as well as to special funds of Wake Forest University for generous travel grants.

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Other genera of Amaryllidaceae which have been studied in my laboratory by myself, students, or colleagues include **Agapanthus, Allium, Calostemma, Crinum, Eurycles, Haylockia, Lepidopharynx, Nothoscordum, Rhodophiala** and perhaps one or two others. In addition such hybrid taxa as X **Cooperanthes,** X **Crinodonna,** X **Rhodobranthus,** X **Sprekanthus** and X **Sydneya** have been investigated. Published accounts of some of these studies have appeared.

I have had additional papers dealing with such taxa, or subjects, as **Asimina, Asparagus, Beaucarnea, Buxus** (4), cabbage (several), Gymnosperms, **Gyratrix, Ilex, Lochnera, Malus** (6), **Phlox** and relatives, **Pisum,** propagation, **Prunus** (13), **Quercus,** radiation (4), **Rosa** (3), and some others - especially a considerable series of rather popular papers dealing with specific or general horticultural subjects which have appeared in various trade and garden journals.

PLANT LIFE LIBRARY—continued from page 9.

CELLS, MOLECULES AND TEMPERATURE, by V. Ya. Alexandrov; translated from the Russian by V. A. Bernstam. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1977. Pp. xi + 330. Illus. $39.60.— Subtitled "Conformational flexibility of macromolecules and ecological adaptation," the text is presented in eight chapters, (1) modificational changes of the primary thermoresistance cells; (2) genotypic changes of the primary thermoresistance cells; (3) variation in thermostability of protoplasmic proteins as a basis for changes in the level of primary cellular thermoresistance; (4) Adaptive modifications of conformational flexibility of macromolecules as a basis for changes of the protein thermostability; (5) the plausible points of application of the natural selection during alternation of a correspondence between the level of conformational flexibility of protein molecules and the temperature ecology of a species, (6) plausible mechanism of regulation of the level of conformational flexibility of proteins; (7) thermostability of nucleic acids and the temperature environment of species' life; and (8) saturation of fatty acids and the temperature conditions of life. An epilogue, literature references, and subject index complete the volume. Highly recommendd.

PLANT LIFE LIBRARY—continued on page 46.

Fig. 2. Dr. Hamilton P. Traub, from photo taken a little before the organization of **The American Amaryllis Society** in 1933 (changed to **The American Plant Life Society** in 1945). It is the first portrait of Dr. Traub to appear in **Herbertia** or **Plant Life.**

The portraits of Messrs. R. W. Wheeler and Wyndham Hayward will be found in the 1947 **Herbertia** and 1958 **Plant Life,** respectively. Judge E. G. Duckworth was a very modest man and never furnished a picture for reproduction in **Herbertia** or **Plant Life.**

THE AMERICAN PLANT LIFE SOCIETY 1933-1976 *

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As the AMERICAN PLANT LIFE SOCIETY approaches the half-century mark, it is an appropriate occasion to record its organization, its history, its goals and its future. Many gardeners, plantsmen, scientists, and even members are ill informed about the Society, and some who would be interested have never heard of it.

The AMERICAN PLANT LIFE SOCIETY is truly a remarkable one because it is largely the idea and product of a single individual, who at a spry 87 years of age, continues to guide its destiny. Here, I am speaking of Dr. Hamilton P. Traub, who was the inspirational leader of the founding group, and has acted as Editor, since the publication of the first volume of Herbertia in 1934.

The Society was founded as the AMERICAN AMARYLLIS SOCIETY, in 1933, at Orlando, Florida, by four gentlemen with a sustained and abiding interest in *Amaryllis*. They were Dr. H. P. Traub, at that time Principal Physiologist with the U.S. Department of Agriculture, working on fundamental research with subtropical fruits; and Wyndham Hayward, an ex-newspaper reporter, and ardent plantsman. Mr. Hayward was also the proprietor of a nursery in Winter Park, Florida, and he acted as the first Secretary of the Society. The other individuals, Judge E. G. Duckworth and Mr. R. W. Wheeler, were local residents, amateur gardeners, with a special interest in *Amaryllis*. Judge Duckworth was the first treasurer of the Society. The four founders immediately commenced to solicit members, searching out those people known to be *Amaryllis* fans, but also professional nurserymen, growers, and scientists.

The Society started business in 1934 with the publication of HERBERTIA Vol. 1, the AMARYLLIS YEARBOOK. By present day standards, Vol. 1 was pretty thin but it contained much good information. It was a forerunner of the successful policy that has made HERBERTIA and its successor, PLANT LIFE, models of communication among the plethora of publications in the plant world. Dr. Traub, as Editor, has skillfully maintained a balance between sound technical articles, and those that record the observations and practical experiences of innumerable gardners. This blend of the two types of articles is necessary because each has lasting value, and they appeal to both the skilled amateur and those with technical training. The result has been a magazine that is not only pleasing to the membership, but through high standards has created a constant demand among individuals and libraries for back volumes of our publications, even though the first volume was published almost one-half century ago.

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* The substance of a lecture presented before the **Southern California Hemerocallis and Amaryllis Society** on November 20, 1976, at the Los Angeles State and County Artoretum, Arcadia, CA.

In 1944, a change in the structure of the Society was made at the request of members to publish also material other than that concerned with the Amaryllidaceae. As a result of this demand the American Plant Life Society was founded in November, 1944. Also, in 1944 the headquarters of the Society were moved from Florida to California and the first volume of Plant Life was published in 1945.

Fig. 3. The beautiful light pink hybrid **Crinum** clone 'Elizabeth Traub' (**Crinum scabrum** ♀ x **Crinum** hybrid clone 'Ellen Bosanquet' ♂), produced by Dr. Traub in the 1930's. Photo by T. W. Whitaker.

As stated, the purpose of Plant Life was to publish material not necessarily concerned with the Amaryllidaceae. For example, Plant Life Vol. 1 (Nos. 2 & 3), 1945, was devoted exclusively to bromeliads. This is one of the best publications on many aspects of this interesting group, including their taxonomy. This volume still enjoys a brisk sale to bromeliad fanciers.

Both Herbertia and Plant Life were published in 1945, 1946, 1947, and 1948. By this time, 1949, dual publication was commencing to overburden the resources of the Society. In order to cut publication costs the two journals were merged under the name "Plant Life and the Yearbook of the American Amaryllis Society." The latter is now an integral part of The American Plant Life Society.

In its short history, 1934 to 1948, Herbertia published some outstanding research. For example, Volume 9 contained an article by Dr.

H. A. Jones which reviewed for the first time a method for the production of hybrid onion seed, and the genetics of this phenomena. At present, most of the onions produced in this country are of hybrid origin. Bulbs from hybrid seed have many advantages over bulbs produced from open pollinated seed. Among the two most important are greater productivity and superior uniformity of the hybrids.

Fig. 4. **Hemerocallis washingtonia** (tetraploid species) clone 'Golden Ring' produced by Dr. Traub in the 1960's. **Crinum bulbispermum** forma **album** in the background. Photo by T. W. Whitaker.

The Society has an impressive publication record. Fifteen volumes of HERBERTIA were issued from 1934 to 1948. Thirty-three volumes of PLANT LIFE have been issued since 1945. In addition, the Society has published the 3 books listed below:

Traub, H. P., and H. N. Moldenke, 1949. Amaryllidaceae: Tribe Amarylleae. Amer. Plant Life Society. La Jolla, CA. 194 pp.

Traub, H. P., 1963. The Genera of Amaryllidaceae. Amer. Plant Life Society. La Jola, CA. 85 pp.

Traub, H. P., 1964. Lineagies. Amer. Plant Life Soc., La Jolla, CA.

163 pp.

Another valuable publication of the Society is a list of *Hermerocallis* clones by Norton, Stunz and Ballard as shown below.

Norton, J. B. S., M. Fredrick Stunz and W. R. Ballard. 1949. Descriptive Catalogue of *Hemerocallis* Clones. 1893-1948. Amer. Plant Life Society, Stanford, CA. 90 pp.

Fig. 5. The large-flowering **Hemerocallis washingtonia** (tetraploid species) clone 'Melon Supreme' produced by Dr. Traub in the 1970's. Flowers are borne on tall branched flower stalks—see Fig. 6. Photo by T. W. Whitaker.

This is a good time to mention a book sponsored by the Society, but published by The Macmilian Co., THE AMARYLLIS MANUAL written by Dr. Traub. This book came out in 1958, and sold like rafts at a shipwreck. The 4000 or so books published were quickly sold, and those individuals foresighted, or lucky enough to buy one, found themselves in possession of a collectors item. THE AMARYLLIS MANUAL has not been reprinted despite a persistent demand, and a revision is not in the immediate offing.

The Society is in possession of the TRAUB PLANT SCIENCE LIBRARY (literature of plant science), the gift of our Editor-Treasurer.

One of the original purposes of the Society was to foster and encourage the staging of *Amaryllis* shows across the country. The first *Amaryllis* show at Orlando, Florida under the sponsorship of the Society took place in 1934. Since that time local *Amaryllis* groups have been formed in Mobile, New Orleans, Houston, Southern California, Corpus Christi (Texas), and perhaps at other locations. These groups regularly stage annual Amaryllis shows.

Another function of the Society is the registration of Amaryllis clones. The name, a brief description, and other information about each clone is published in Plant Life. Obviously, this service is a vital one for the development of an orderly system of identifying clones and preventing the duplication of names. Up to the present several hundred clones have been registered.

An important fringe benefit available to members of the Society is the opportunity to trade plant materials and exchange information among individuals with similar interests. Dr. Traub, for example, is continually distributing seeds and bulbs to those people with interests in particular groups.

The responsible officers of the Society have tried to keep the dues structure as low as possible, yet cover the costs of the Society's publications and a few minor incidentals. There are no paid employees, although the Executive-Secretary receives a small annual honorarium, which is used mostly to hire a part-time clerical assistant to help with the office chores. Galloping inflation finally caught up with us, and we were forced to raise the annual price of membership from $5.00 to $7.00 in 1974. At $7.00, membership in the AMERICAN PLANT SOCIETY is a bargain compared with the dues of similar organizations that offer comparable services to members.

The annual award of the prestigious HERBERT MEDAL is another notable activity of the Society. The HERBERT MEDAL is conferred upon those individuals deemed worthy, by contributing significantly to the sum-total of our knowledge of the Amaryllidaceae. The award recipients are chosen by the Executive Committee. The Yearbook is dedicated to the Herbert Medal awardee of that year, and carries his autobiography and photograph. Many outstanding scientists and laymen have been honored for their work with this group of plants. Among them are Dr. H. A. Jones, now of El Centro, CA; the late W. Quinn Buck of Arcadia; Sam Caldwell of Nashville, Tenn.; Mrs. Morris Clint of Brownsville, Texas; Mrs. Mary G. Henry of Gladwynne, Penna.; Leonard Doran of Burbank, California; John Cage of Yuba City, California; the late Dr. Martin Cardenas of Cochabamba, Bolivia; and a number of others. The first Herbert Medal Award was made in 1937 to Mr. Arthington Worsley, of Ventnor, Isle of Wight, England, for his pioneer work with the Amaryllidaceae. In all, 49 individuals have received the Herbert Medal; two posthumously, and in 1938, in an effort to catch-up with deserving recipients, five awards were conferred.

The Society had a modest endowment of about \$25,000, a gift of our Editor-Treasurer. This endowment was increased by the proceeds from the estate of the late W. Quinn Buck. The sum realized from this source is \$40,582. It is proposed that the interest from this endowment will be used to defray publication costs. Specifically, the additional income generated by these funds will allow us to increase the amount of material published in PLANT LIFE, and perhaps publish an occasional monograph.

Fig. 6. **Hemerocallis washingtonia** (tetraploid species) clone 'Melon Supreme', a tall plant with very large melon-colored flowers (see also Fig. 5) with creped texture and ruffled edges (upper left). Somewhat out of focus (right), shows good branching on tall plant as contrasted with the usual weak melon tetraploids. Introduced by Dr. Traub in the 1970's. Photos by H. P. Traub.

If I interpret the goals of the "founding fathers" of the AMERICAN AMARYLLIS SOCIETY correctly, it was their original purpose to increase the knowledge and appreciation of the amaryllids, later amended to include all plants, and to communicate the results to any who might be interested. The record suggests that the Society has been reasonably successful in achieving this goal. There are, however, many areas that have only been lightly touched or studied. Take for example, plant exploration; Len Doran has shown what can be accomplished by thorough exploration of the lesser known areas of Brazil and Bolivia. The generous harvest of new germplasm of *Amaryllis* brought to this country by Doran and his co-explorers will no doubt enrich our gardens for generations to come. There is no reason to doubt that careful selection of likely areas with the purpose of extending the search for new germplasm would be equally rewarding.

Another area badly in need of investigation is that of disease and

pest control. It is disheartening to raise plants up to flowering stage, and at that point see them disfigured or destroyed by insects, fungi, or virus. We also need more basic information about growing these plants. This is a wide open field where a knowledgeable plant physiologist could make a significant contribution. Lastly, in the area of plant taxonomy there is a need for young, well trained persons interested in this group to carry on with the prodigious work accomplished by Dr. Traub. It is essential that we know the names of our plants and their relationship to each other.

And finally we need a group of dedicated young people to carry forward the work of the Society that has been so diligently and unselfishly handled by Dr. Traub for over four decades. If we pursue these suggested goals and perhaps others with vigor and persistence we can anticipate a bright future for the Society with continued services to its members.

Fig. 7. The Herbert Medal Award to Mrs. Emma D. Menninger (center) by C. D. Cothran (right), April 24, 1977. Charles Hardman (left). Photo by Phil Rosoff.

PRESENTATION OF THE HERBERT MEDAL APRIL 24, 1977

One of the highlights of the thirteenth annual Show of the Southern California Hemerocallis and Amaryllis Society was the presentation on Sunday morning, April 24 of the Herbert Medal Award of the American Plant Life Society to Mrs. Emma Menninger by C. D. Cothran on behalf of Dr. Traub and the Directors of the American Plant Life Society. On Sunday morning, Show visitors, a number of friends and acquaintances of Mrs. Menninger, and many fellow members of the Southern

California Hemerocallis and Amaryllis Society gathered by the trophy table in the Lecture Hall of the Arboretum where a brief message from Dr. Traub regarding the Award was read to Mrs. Menninger by Mr. Cothran. The Herbert Medal was then handed to her, and she was congratulated by a number of people.

Mrs. Menninger responded by saying that she was delighted to receive the Medal, but it seemed not quite right to receive a medal for something she enjoyed doing so much. Among the cited accomplishments for receiving the Award was her work with Nerines, particularly some lovely white ones. Developing these according to Mrs. Menninger was not work, but a hobby, and it was very nice to receive a commendation for something it was such a pleasure to do.

Prior to Mrs. Menninger, three other members of the Southern California Hemerocallis and Amaryllis Society have been awarded the Herbert Medal; Mr. Leonard Doran, Mr. Quinn Buck, and Mr. John Cage. Only Mr. Leonard Doran was able to be present at the above ceremony.

After the presentation and taking of photographs Mrs. Menninger greeted a number of friends, and with Mr. Charles Hardman then proceeded to enjoy the Amaryllis Show.—*C. D. Cothran*

EDITOR'S MAIL BAG

The Editor enjoyed a pleasant visit from Mr. & Mrs. Raymond J. Chesnick, 130 W. La Cienega Road, San Marcos 92069 on Sunday, February 6, 1977. They delivered the Robert P. Miller Medal bestowed upon me by the American Hemerocallis Society in 1975 for my introduction of *Hemerocallis washingtonia* (tetraploid species) clone 'White Cloud'.

The Editor enjoyed a visit from Mr. G. A. M. Zuidgeest, the noted hybridizer of Nerines, Middelbroekweg 71, Honselersdijk, Netherlands, and Mr. Hans Rood, Koninginnelaan 48, Rijk (Z. H.), Netherlands, in May 1977.

Members of the Society interested in plant tissue culture will want to consult "Plant Tissue Culture and Its Bio-technological Application", edited by Barz, Reinhard and Zenk, reviewed in the present issue of PLANT LIFE. It should be available at the larger libraries.

Otto Koeltz, Antiquariat, P. O. B. 1360, D-6240 Koenigstein, Western Germany, lists Traub *The Amaryllis Manual*, 1958, at 49.—DM (Deutsche Marks). This is a rare opportunity to obtain this collector's item. How many copies he has is not indicated.

1. REGIONAL ACTIVITY AND EXHIBITIONS

The 1977 Amaryllis Show Season began early on March 26 with the 1977 Greater New Orleans Official All-Horticulture Amaryllis Show, followed by the 1977 New Orleans Intra-Club Amaryllis Show on April 2, 1977. The Corpus Christi (Texas) Amaryllis Show was held on April 2nd and 3rd, and the Greater Houston Amaryllis Club Show followed on April 4, 1977. The Amaryllis Society of Alabama Show was staged on April 16th and 17th, and the Houston Amaryllis Society Official Show on April 17th. The Southern California Official Amaryllis Show was held on April 23rd and 24th. The season closed with the Spring Extravaganza at Arcadia, California on May 21st and 22nd.

NOTE TO AMARYLLIS SHOW ORGANIZERS

It is important to designate some one to write a *brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub, Editor, Amaryllis Year Book, 2678 Prestwick Court, La Jola, Calif. 92037. *Your plans are not complete until this appointment has been made.* Only in this way is a permanent international record of your show assured.

1977 GREATER NEW ORLEANS OFFICIAL ALL-HORTICULTURE AMARYLLIS SHOW

L. W. Mazzeno, Jr.
944 Beverly Garden Drive, Metairie, La. 70002

The eighteenth annual all-horticulture Amaryllis Show of the Men's Amaryllis Club of New Orleans was held in the fountain area of Lakeside Shopping Center Mall in Metairie, Louisiana. The date was March 26, 1977, the earliest date chosen for the Show in many years. As is the usual custom the public was invited to participate in the show. They responded with 35 of the total 208 entries, nine blue ribbons and one trophy.

This winter in New Orleans was the coldest in quite a number of years and its effect on the number of Show entries was quite evident. However, despite the shortage of entries the overall quality was the best in many years.

Continuing the pace he set in the two preceding years, Holly H. Bowers, Jr. carried off the Lion's share of the trophies; the "Best in Show" rosette, the H. Bowers Award and the Member's Choice Rosette for a beautiful but unregistered seedling; the James Mahan Memorial Award for the best named and registered hybrid as well as the Ludwig Challenge Cup with a "Ludwig It"; the T.A.C. Constuction Co. Award for best unnamed and unregistered hybrid; the Reuter Seed Co. Inc. Award for best cut flower; the O. J. Robert, Sr., Trophy for best three-

floret potted registered hybrid "Ludwig Dazzler"; the George Merz, Jr. Trophy for most blue ribbons (27) won by a Club member; and two Sweepstakes Rosettes. The Robert Diermayer Memorial Award, certainly one of the most coveted awards in the Show was merited by A. T. Diermayer for the best hybrid in the Breeder's Class. He also took the Amaryllis Inc. Award for Best Amaryllis Species with a "Pardina"; the Jerome Peuler Trophy for best unnamed single floret specimen; the Lester Laine Trophy for best potted specimen double flower; and the Nola Luckett Trophy for the best two-floret potted specimen with a "Beautiful Lady".

Fig. 8. (From left to right) Messrs. L. W. Mazzeno, Jr., A. T. Diermayer and H. F. Bowers, Jr., at the Men's Amaryllis Club of New Orleans Show. 1977, admiring a choice exhibit.

With a "Pamela", L. W. Mazzeno, Jr. won the W. J. Perrin Memorial Award for runner-up to the best registered and named hybrid, and the Laurence Mazzeno Trophy for best minature hybrid. The Edward F. Authement Memorial Award for runner-up to the best unnamed, unregistered hybrid was also won by L. W. Mazzeno, Jr.

The Vincent Peuler Trophy for best registered single floret went to L. W. Mazzeno, Sr. with a magnificent "Glorious Victory" for the second straight year with the same hybrid.

Also repeating her accomplishment was non member Cathy Gautier

who was runner-up in the Breeder's Class and took home the Southern Seed and Popcorn Co. Inc. Trophy.

Over half the membership entered flowers in the Show. In addition to the above mentioned winners the following merited blue ribbons: T. A. Calamari, Jr., Emile Flouss, Albert Touzet, Jerome Peuler, Lester Laine, Harold Reinhardt, Al Flores, Oscar Robert, Victor Pannell, and Vincent Peuler.

The success of any horticultural show depends on the combined efforts of many people. The prime mover in this Show was our general chairman, A. T. Diermayer, Jr. In addition to overseeing all the operations on the day of the Show he was also responsible for extensive publicity in major national gardening magazines, local newspapers, radio and television coverage. He was ably assisted by co-chairman Vincent Peuler and other members too numerous to mention here. We must, however, recognize especially our judges who gave so generously of their time to perform their difficult task in their usual dedicated manner. And, last, but by no means least to the donors of all of our trophies. Their awards are certainly a highlight of our Show each year.

1977 NEW ORLEANS INTRA-CLUB AMARYLLIS SHOW

L. W. Mazzeno, Jr.
944 Beverly Garden Drive, Metairie, La. 70002

The fifth annual Intra-Club all horticulture Amaryllis show was staged by the Men's Amaryllis Club of New Orleans on April 2, 1977 in the City Park Backer Room. Sixteen members entered 56 specimens in the competition. Trophies were awarded to George Merz, Jr. for the best 4-floret specimen, "Cupido"; and, to Emile P. J. Flauss for the best 3-floret specimen, "Candy Cane", and best 2-floret specimen, "Prima Donna".

The Club's regular annual Show, open to the public, was held March 26, and is reported separately.

1977 CORPUS CHRISTI (TEXAS) AMARYLLIS SHOW

Mrs. Carl C. Henny, *Corresponding Secretary,*
P. O. Box 3054, Corpus Christi, Texas 78404

Our Annual "Festival of Flowers" was held on April 2nd and 3rd, despite the fact that we "Texans" suffered severe cold and wet weather for four months, with an early freeze, which damaged many of our hardy plants. However, our Amaryllis bulbs were protected by mulching and did not suffer any damage. Those planted in pots were protected from the cold—by placing them in lath houses or greenhouses. The Theme for our Show was "Texas Brags".

We were fortunate in having 65 entries for our Amaryllis Display, since some of our named varieties bloomed early or did not bloom until after our show date.

Ludwig named and registered bulbs and specimens entered were:

'Apple Blossom', 'Fire Dance', 'Fantastica', 'Ludwig's It', 'Peppermint', 'Royal Dutch', 'Pinksterflower', and Hippeastrum Pink. Among the Gracilis Type were: Bianca, Carina, Firefly, Little Sweetheart, Melody Lane, Picture, and Pixie. Also among the Ludwig named varieties were: Beautiful Lady, Front Page, Ludwig's Goliath, Sight Show, and Trixie. Mrs. Carl Henny entered a lovely dark red Van Meeuwen specimen named "Belinda". Mr. J. M. Mabe entered a lovely potted "Hadeco-Apple Blossom."

Mr. J. M. Mabe was awarded the "Silver Bowl" given club members for receiving the greatest number of blue ribbons in the Ludwig Registered and Named Amaryllis. He also received an "Award of Merit" from the Council of "Garden Clubs" and from "The American Amaryllis Society" for his entry of "Apple Blossom", which scored 96 points.

Mrs. Carl C. Henny, club member, received a "Special Trophy" for receiving the greatest number of blue ribbons in the "BREEDERS CLASS".

Awards of Merit from the American Amaryllis Society were also given to:

Mrs. Elsie Balke, for her entry of Hippeastrum-Pink scoring 95 points.
Mr. Loise Rockowitz, for his entry of "Johnsonni"—scoring 95 points.

Preliminary Commendation Awards were given to: (from the American Amaryllis Society):

Mrs. Carl C. Henny, Mrs. Vlasta Kruse, Mrs. J. M. Bluhm, Mrs. A. S. Meers, and Mrs. D. L. W. Carter, for their entries—all scoring 95 points.

Judges for the Amaryllis Exhibit were: Mrs. E. B. Jenks, Master Judge and Mrs. D. P. Martin, National Judge and Amaryllis Judge—both from San Antonio, Texas. Also Mrs. C. E. Weeks, a Master Judge, from Corpus Christi, Texas.

Mrs. Elsie Balke, Club president, arranged a Propagation Display, which contained seeds from Amaryllis, year old bulblets and 2 year old plants, and a potted Amaryllis in bloom which interested many who were attending the "Plant Sale Booth".

THE GREATER HOUSTON AMARYLLIS CLUB SHOW

Mrs. Sally Fox, *Corresponding Secretary,*
1527 Castle Court, Houston, Texas 77006

Due to weather conditions, the Greater Houston Amaryllis Club presented an Educational Show on April 4, 1977 at the Houston Garden Center, which proved to be very popular. As with all States, Texas had its share of unusually cold weather and the amaryllis were slow in showing buds by this early date which resulted in only about fifty exhibits entered. A panel of Judges discussed each specimen, in conjunction with the new scale of points, and scored each for the benefit of members and visitors, and much was gained by those who strive to enter

show quality blooms.

Amaryllis Species along with Clivias added interest to the show, and we had our usual entries by those who have been carrying on a gratifying hybridizing program. Each year there are more Dutch seedlings shown, and are probably the most popular feature of the shows. Those showing seedlings gave demonstrations of hybridizing, and answered questions concerning selection of crosses for floret shape and color. The results of cross-pollination was shown in each stage of development from seed pod, to planting of the seeds and the progress made, showing growing plants, through the several years to the mature plant. We also presented an exhibit on different methods of vegetative and asexual propagation for those who were interested in multiplying a particular variety.

The exhibit with samples of potting ingredients, fertilizers and suggested potting procedure was of interest to the visitors, as well as learning from our Hostesses when was the proper time in our Gulf Coast area to fertilize, put out insect repellants, mulch, etc.

Although some specimens had abnormalities in the scape and florets due to the cold Winter, there were trophy quality entries shown as per the decision of the Judges. Mrs. Bertha Cone showed "Ludwig's Goliath" which scored 98 and "Twinkling Star" received a 96. Mrs. P. A. Froebel's two Ludwig entries "Bouquet" and "Eastern Dream" received 98 each and her Van Meeuwen's "Glorious Victory" a 95. Mrs. Louise Fawcett's dark, dark red "Seedling" gave her a score of 97.

Each show attracts visitors who are mainly interested in arrangements and even though we did not have an official show the Artistic Division's use of amaryllis would not have made you feel there was a shortage of blossoms. They showed a magnificent combination of amaryllis with other materials.

Our Show Chairman, Mrs. John H. Ellett, was delighted that we converted our show into this facinating Educational Show and were able to continue to 'promote interest in growing amaryllis'.

THE AMARYLLIS SOCIETY OF ALABAMA INC. SHOW - 1977

MRS. VELMA THOMPSON, *President,*
Box 17, Mt. Vernon, Ala. 36560

The Amaryllis Society of Alabama Inc., held its Ninth Annual Spring Show at the Chickasaw Civic Center on Grant Street in Chickasaw, Alabama on April 16th and 17th, 1977. The theme of the show was "Curtain Call for Amaryllis". There was much interest shown in both the horticulture and artistic arrangement divisions. Mr. Dewey Hardy of Eight Mile was the Show Chairman this year.

Mr. Dewey Hardy of Eight Mile, Alabama won the AMERICAN NATIONAL BANK TROPHY for the best named Dutch potted specimen in the show, in addition, Mr. Hardy won the following trophies: CLAUDE H. MOORE MEMORIAL TROPHY, THE WILMER

SMITH TROPHY, THE CECIL BATES TROPHY.

Mr. C. E. Tagert of Mobile won the following trophies: PRESIDENT'S AWARD, CHAVIS FURNITURE COMPANY TROPHY, EMILE SCHEURMANN, SR., MEMORIAL TROPHY, AMARYLLIS SOCIETY OF ALA., INC., TROPHY, MERCHANTS NATIONAL BANK TROPHY, MARTHA BURDETTE MEMORIAL TROPHY, T. J. SWETMAN TROPHY, VINCENT KILBORN SR. MEMORIAL TROPHY, C. E. TAGERT SR., TROPHY, and C. E. TAGERT SR., TROPHY.

Mrs. Claudine Pierce of Mt. Vernon won the MR. & MRS. H. P. WHEAT MEMORIAL TROPHY.

Mrs. Mittie Young of Chickasaw, won the following trophies: LITTLE GLASS SHACK AWARD, and GAYLORD'S DEPT STORE AWARD.

Mrs. Velma Thompson of Mt. Vernon won the CLAUDINE PIERCE TROPHY.

Mae Brown of Mobile won the following trophies: CENTRAL BANK OF MOBILE TROPHY, and the MAE BROWN TROPHY.

Mrs. Betty Hardy of Eight Mile won the following trophies: VELMA THOMPSON TROPHY, and MITTIE YOUNG TROPHY.

Mrs. Mae Allen of Chickasaw won the ALABAMA FURNITURE COMPANY TROPHY.

Mrs. Irene Massingill of Chickasaw won the SULLY'S DRIVE-IN TROPHY; Mrs. K. W. Koontz of Mobile won the following trophies in the Non-Member Class: two AMARYLLIS SOCIETY OF ALABAMA, INC. TROPHIES.

The Judges for the show were from Hattiesburg, Mississippi: Mrs. Luther N. Davis, Mr. Luther N. Davis, Mrs. E. R. Trussel, Mr. E. R. Trussel, Mrs. Mollie Fowler, Mrs. Maye Gaucher, and Mrs. Ethel F. Newton.

After the judging of the show, the Judges were guests of the Amaryllis Society of Alabama, Inc., at a luncheon at a Mobile Restaurant.

HOUSTON AMARYLLIS SOCIETY OFFICIAL SHOW 1977

MRS. A. C. PICKARD, *Official Show Chairman*
1909 Alta Vista, Alvin, Texas 77511

Flower Show Chairman, Mrs. Troy Wright; Staging Chairman, Mrs. R. L. Culpepper; Artistic Chairman, Mrs. E. Blankenship; Publicity Chairman, Mrs. A. Brittian; Plant Sales Chairman, Mrs. Nellie Thompson; Honorary Chairman, Mrs. L. E. Morgan.

The theme of the April 17, 1977 Houston Amaryllis Society Official Show, was "Amaryllis, The Beautiful Lady", which covered all classes, including the Artistic Section and tested the skills of our judges. The Award winners of the show were as follows: *Award of Merit*--'Beacon', Leopoldii type, Div. 5, bulb in possession less than one year.

exhibited by Mrs. L. E. Morgan: *Second Award*—'Apple Blossom', Leopoldii type, Div. 5, bulb in possession more than one year, exhibited by Mrs. Wm. Birch: *Queen of the Show* 'Zenith', Leopoldii type, Div. 5, bulb in possession more than one year, exhibited by Mrs. E. Koon; *Species Award*—*Amaryllis striata*, Div. 1, exhibited by Mrs. A. F. Legatski: *Miniature hybrid Award* "Graceful Clone", Div. 8, exhibited by Mrs. L. E. Morgan.

The weather was extremely cold during the winter, holding the garden bulb blooms to a minimum for the Spring show. The Artistic Section, with Amaryllis predominant, was non-competative and displayed in unique containers which offered great originality and inspiration.

With the Spring Amaryllis enthusiasm at its peak, the Educational Table was well supplied with all the answers to cultural questions. There were demonstrations of potting, planting seeds, soil mix, and methods of propagation.

The plant sale tables offered many varieties of plants and bulbs plus a lot of friendship and aid to the horticulturist.

The show was judged by official Amaryllis judges.

1977 SOUTHERN CALIFORNIA OFFICIAL AMARYLLIS SHOW

Gladys Williams and Joe Werling, *Chairpersons*

Southern California Official Hemerocallis and Amaryllis Show of 1977 was held at the beautiful Arboretum in Arcadia, April 23rd and 24th.

The success of the Thirteenth Annual Amaryllis Show can be attributed to the diligent efforts of many dedicated members. The theme "Spring Gladness and Madness" attracted a record attendance of over 8,000 persons for this two-day event.

The background flowers were again donated from the late Mr. Angell's Loma Linda field of Amaryllis, courtesy of the Angell family. Mr. Bruce Claflin also offered many cut blooms for our show from his numerous Amaryllis seedling crosses. Mr. Claflin grows his bulbs in rows between the avocado trees on his acreage at the foot of the Sierra Madre mountain range at Upland in a very rocky wash.

Due to variable weather conditions the flowers unfolded their splendor somewhat spasmodically in the open fields and in the gardens. In spite of this irregularity we had a successful show and the Show Committee was very appreciative of the many flower scapes the members contributed.

For the first time the Show Committee, headed by Gladys Williams offered a bulb sale to the public. Towards the far end of the exhibition hall the bulbs were sold. Our sale was unique because each bulb had its flower scape intact so that there would be no doubt as to

what color and form a purchaser would be buying. The few dollars the Society realized would help support the Society's public service program. The bulbs were from the Angell family's growing grounds.

The Flower Arrangement section of our Thirteenth Show was a togetherness adventure mainly by Alice Hanson, Marion Harshbarger, and Dorothy Rose. An arrangement of green and mohogany Papillio by Marion Harshbarger centered the awards table. Some of the materials for the background were collected and trucked in by Harold and Dorothy Rose from far away places. Considerable public interest in these artistic displays were especially noted.

Mrs. Emma Menninger was awarded the Herbert Medal. More about that in Mr. Cothrans seperate article.

1977 SHOW BASICS

1. Sweepstakes for most blue ribbons—The Cecil Houdyshel Trophy won by Dee Cothran.
2. The Sweepstake runnerup—to Fred Boutin.
3. Best registered Ludwig variety scoring over 95 points—Ludwig Challenge Cup to Dee Cothran for "Marie Goretti".
4. Best registered, other than Ludwig—to Fred Boutin for "Parsival", scoring 95½ points.
5. Best liked flower in show from Judges viewpoint—to Fred Boutin for Seedling No. 29 - Mauve and White.
6. Popularity Poll winner No. 54—a seedling Blended Creamy Pink Picotee - to Dee Cothran. All received silver awards.

HYBRIDIZERS AWARDS

A. Best Leopoldii seedling No. 68 - to Sterling Harshbarger.
B. Best Reginae seedling No. 77 - to Dee Cothran.
C. Best Gracilis seeding No. 14 - to Ed Pencall.
D. Best small flowered Leopoldii seedling No. 131 - to Henry Myers.
E. Best Belladonna seedling No. 18 - to Dee Cothran.
F. Best overall seedling No. 68 -The Quinn Buck Memorial Trophy - to Sterling Harshbarger.

P.C. from American Amaryllis Society went to Fred Boutin for No. 89, to Sterling Harshbarger for No. 68, to Dee Cothran for No. 77 which scored 93 points. No. 81 - 91½ points and No. 54 to Ed Pencall, No. 38 and No. 49 rating 90 points and 88½ points. Awards of Merit to Sterling Harshbarger for "Nostalgia". Awards of Merit to Fred Boutin for "Parsival" and Awards of Merit to Dee Cothran for "Marie Goretti".

Judges special ribbons were given to Dee Cothran for a double specimen, to Sterling Harshbarger for a Papilio seedling, Fred Boutin for a Komen variety, Bruce Claflin for a purple-red No. 24 and Dr. Rogers for No. 128 seedling.

Rosettes went to Alice Hanson, Marion Harshbarger and Dorothy Rose for special arrangements. Also to Jim Wienstock, Bruce Claflin, and Angell Family for the colorful background flowers they donated.

There were fourteen exhibitors, several hundred exhibits, hundreds of background flowers from Mrs. Crystall Angell, Mr. Bruce Claflin and Jim Wienstock.

Judges for the Show were Gladys Williams, Roger Fesmire, Jack McCaskill, Fred Boutin and Joe Werling. Special thanks to all who participated.

A highlight after the show and in conjunction with our regular June meeting was a pot luck lunch. All members were invited to express their views and ideas to improve our show for the next year. Senior members offered cultural information and help to our new members in order to enable them to grow show flowers to compete for awards.

1977 SPRING EXTRAVAGANZA

C. D. COTHRAN,
1733 North Gibbs St., Pomona, CA. 91767

The California Arboretum Foundation and the Los Angeles State and County Arboretum at Arcadia, California presented their Spring Extravaganza for the third year, and the Southern California Hemerocallis and Amaryllis Society was again invited to put in a display. The Extravaganza was held on May 21st and 22nd, and the display area was a large tent-like structure of Saran netting with several tables set up for each exhibiting society.

C. D. Cothran was chairman, and was ably assisted by Gladys Williams, Bob Melton, Joe Werling, Sterling and Marian Harshbarger, Mary Geraci, Mildred Cothran, Leonard Doran and Cora Doran, Kenneth Mann, Dorothea Boldt, and Ed Pincall. About fifty scapes of amaryllis, and several hundred blooms of hemerocallis, the latter mainly from Bob Shufeldt's garden were displayed. Also several fine scapes of alstromeria were brought by Joe Werling. Hundreds of camera fans were busy both days, and a scape of Beautiful Lady with four huge blossoms was the principal model.

Amaryllis seeds were given to all who wanted them with instructions for planting and growing on the seedlings. At least two people manned the display at all times during the two days, answered hundreds of questions, and we think we made many friends. Some visitors told of success they had with seed given last year, and one person brought plants to prove it. The Arboretum count showed over ten thousand visitors per day, but we have no way of knowing how many stopped at our display.

AMARYLLIS JUDGE'S CERTIFICATES

Since the last report in the 1974, AMARYLLIS YEAR Book (pp. 28; vi) the following numbered Amaryllis Judges Certificate have been issued:

No. 199. Mr. Frederick C. Boutin, 169 S. San Marino Av., Pasadena, Calif. 91107. Horticulture only.

PLANT LIFE LIBRARY—continued from page 27.

CHROMOSOME BOTANY AND THE ORIGIN OF CULTIVATED PLANTS, 3rd. revised edition, by C. D. Darlington. Hafner Press, 866 3rd Av., New York City 10022. 1973. Pp. xvii + 237. Illus. $12.95.—This revision of a standard text on the subject after more than a quarter of a century will be welcomed. The subject is presented under seven headings, (1) the chromosomes, (2) plants in groups, on the species level, (3) plants in space; chromosome ecology, and geography—polyploidy, basic number, internal hybridity and the effects of migration, (4) plants in time; the four levels of change, basic numbers, chromosome individuality and evolutionary principles; and polymorphism, (5) cultivated plants; (6) ornamental plants, and (7) lessons from chromosome botany. Two appendices, a bibliography and an index complete the volume. Highly recommended.

MEDICINAL BOTANY: PLANTS AFFECTING MAN'S HEALTH, by Walter H. Lewis and Memory P. F. Elvin-Lewis. John Wiley & Sons, 605 3rd Av., New York City 10016. 1977. Pp. xvi + 515. Illus.—The authors have designed this attractive book to bring into perspective the massive knowledge acquired by man to retain his health by using the plants around him." The book is arranged in three sections (1) "Injurious" plants, (2) "Remedial" plants, and (3) "Psychoactive" plants—stimulants, hallucinogens and depressants. There are two appendices (1) outline grouping of the Plant Kingdom which is two decades behind the times [(see Traub, PLANT LIFE **33:** 85-104. 1977), and thus do not recognize Kingdom **Procaryotae,** including the Blue Green Algae **(Cyanophyta),** etc., with the procaryotic cellular organization, and Kingdom **Eucaryotae,** including Subkingdom 1. **Plantae,** the Green, brown, etc. Algae, and vasculat plants—Bryophytes and vascular plants; Subkingdom 2. **Mycotae** (fungi), and Subkingdom 3. Animalia, all with the **eucaryotic** cellular organization] and. (2) Bibliography of herbal medicine. A glossary and Index complete the volume. This outstanding book is highly recommended.

ANATOMY OF SEED PLANTS, 2nd Edition, by Katherine Esau. John Wiley & Sons, 605 3rd Av., New York City. 10016. Pp. xx + 550. Illus. $16.95.—This second edition of a standard text on plant anatomy for students who have had a relatively limited experience in this field, after the lapse of 16 years of progress, will be welcomed for it brings the subject up-to-date. Highly recommended.

BIOCHEMISTRY OF PHOTOSYNTHESIS, 2nd Edition. By Richard P. F. Gregory. John Wiley & Sons, 605 3rd Av., New York City. 10016. 1977. Pp. xiv + 221. Illus.—This second edition of a standard text on photosynthesis brings the subject up-to-date to the end of 1975. The subject matter is arranged in two parts: (1) the context of photosynthesis; the absorption of light; light energy into chemical energy; electron transport; the path of carbon, and (2) evidence for two light-reactions in photosynthesis in green plants; structure of the thylakoid membrane; photosynthetic electron transport; phosphorylation, and chloroplast metabolism and its relation to that of the cell. An appendix, references and author and subject indices complete the volume. Highly recommended.

RESIDUE REVIEWS: RESIDUES OF PESTICIDES AND OTHER CONTAMINATS IN THE TOTAL ENVIRONMENT. VOL. 67. THE CITRUS INDUSTRY PROBLEM: RESEARCH ON ITS CAUSES AND EFFECTS AND APPROACHES TO ITS MINIMIZATION. Edited by Francis A. and Jane Davies Gunther. Springer-Verlag New York, 44 Hartz Way, Secaucus, N. J. 07094. 1977. Pp. 134. Illus. $16.80.—This report is concerned with an estimate of the extent of the problems; foliar dislogable residues; fruit rind residues; orchard dust residues; airborne residues; methods for assessing hazards in treated groves; and summary and conclusions. A list of references and an index complete the volume. Indispensible to all interested in environmental pollution.

PLANT LIFE LIBRARRY—continued from page 68.

2. LINEAGICS

[BIOEVOLUTION, DESCRIPTION, DETERMINING RELATIONSHIPS, GROUPING INTO LINEAGES]

KNOWN DISTRIBUTION OF **HYMENOCALLIS** SALISBURY IN NORTH AND MIDDLE AMERICA AND THE WEST INDIES

WALTER S. FLORY
Wake Forest University

Species of *Hymenocallis* have leaves and flowers quite similar to those of the Old World Pancratiums. It is not surprising then that many of the "White Spider-Lilies" first collected and described from the Americas were included in the genus *Pancratium*.

The original volumes of Jackson and Hooker's INDEX KEWENSIS (1893-95) reveal that 45 American species originally described under *Pancratium* were later transferred to *Hymenocallis*. Indicating the complexity of these groups is the considerable synonymy involved with the 45 taxa referred to. Below are listed the species originally placed with *Pancratium*, under the *Hymenocallis* species to which they were transferred.

HYMENOCALLIS TAXA FIRST DESCRIBED AS PANCRATIUM SPECIES

1. **Hymenocallis Amancaes** Nichols
   - **Pancratium Amancaes** (Ker Gawl.)
2. **H. calathina** Nichols
   - **P. calathiforme** Red.
   - **P. calathinium** Ker Gawl.
   - **P. narcissiflorum** Jacq.
3. **H. caribaea** (L. emend. Gawl.) Herb.
   - **P. amoenum** Salisb.
   - **P. angustum** Ker Gawl.
   - **P. caribaeum** Linn.
   - **P. declinatum** Jacq.
   - **P. excisum** Linn.
3. **H. caribaea** (cont.)
   - **P. patens** Delile
   - **P. recurvatum** Stokes
4. **H. caymenensis** Herb.
   - **P. patens** Lindl.
5. **H. crassifolia** Herb.
   - **P. coronarium** LeConte
   - **P. crassifolium** Schult.
   - **P. occidentale** LeConte
6. **H. expansa** Herb.
   - **P. expansum** Sims
7. **H. glauca** Roem.
   - **P. glaucum** Zucc.
8. **H. quitoensis** Herb.
   - **P. quitoense** Schult.
9. **H. lacera** Salisb.
   - **P. carribacum** Mill.
   - **P. discoforme** DC
   - **P. mexicanum** Lindl.
   - **P. rotatum** Ker Gawl.
10. **H. littoralis** (Jacq.) Salisb.
    - **P. acutifolium** Sweet
    - **P. americanum** Mill.
    - **P. Dryandri** Ker Gawl.
    - **P. illyricum** Blanco
    - **P. littorale** Jacq.
    - **P. mexicanum** Lindl.
    - **P. Staplesi** Steud.
11. **H. ovalifolia** Herb.
    - **P. ovalifolium** Steud.
12. **H. ovata** Roem.
    - **P. amoenum** Ker.
    - **P. fragrans** Salisb.
    - **P. ovatum** Mill.
13. **H. pedalis** Herb.
    - **P. pedale** Schult.
14. **H. speciosa** Salisb.
    - **P. caribaeum** Curt.
    - **P. formosum** Hort. ex M. Roem.
    - **P. latifolium** Mill.
    - **P. speciosum** Salisb.
15. **H. tenuiflora** Herb.
    - **P. tenuiflorum** Herb. ex Steud.
16. **H. tubiflora** Salisb.
    - **P. guianense** Ker Gawl.
    - **P. petiolatum** Willd.
    - **P. tubiflorum** Schult.
17. **H. undulata** Herb.
    - **P. Boschianum** Walp.
    - **P. triphyllum** Willd., ex M. Roem.
    - **P. undulatum** H.B.K.

Other species first included under *Pancratium* were later transferred to such additional genera as *Elisena*, *Eurycles*, *Ismene*, *Stenomesson*, *Urceolina* or *Vagaria*. Further, the members of some of these genera

were later included with *Hymenocallis.*

ESTABLISHMENT OF **HYMENOCALLIS**

Salisbury in 1812 recognized that the New World relatives of the Old World genus *Pancratium* differed in having seed which were fleshy - rather than non-fleshy; leaves which ran from sessile to petiolate - rather than all having sessile leaves; and with the free parts of the filaments being greater in usually being one-half to 2 inches in length, rather than only about one-quarter inch long. As a consequence Salisbury (1812) moved many of the New World taxa originally placed in *Pancratium* to the new genus *Hymenocallis*, with other species being moved from *Pancratium* to two other newly described genera - *Eurycles* and *Ismene.* Other genera were described for closely related taxa, some of which were later moved to *Hymenocallis.* For instance, Herbert established the genus *Stenomesson* (1821), as well as the genera *Elisena* and *Vagaria* (1837). *Urceolina* was differentiated by Reichenbach, in 1828. Several species originally described under *Pancratium* were eventually moved to each of these genera.

Two treatments of *Hymenocallis* have appeared in comparatively recent years. Sealy's review (1954) recognized 27 species, while 5 others were listed as probably belonging here. Dr. Traub's 1962 treatment which included 56 species, considered *Elisena, Pseudostenomesson* and *Ismene* as subgenera of *Hymenocallis,* and included several of the southeastern United States taxa collected by the late Mrs. Mary G. Henry as new species of *Hymenocallis.* Since 1962 several additional species of *Hymenocallis* collected in Mexico by Dr. Thad Howard and his associates, by Mrs. Morris Clint, and perhaps by others, have increased the number of known species. Additional species from the United States have been described by Moldenke (1967), and Traub (1967).

GEOGRAPHICAL LOCATION OF SPECIES

In Table 1 are listed the known species and hybrids of *Hymenocallis.* Following the name of the several species the country, state, island, or

---

Table 1. **Hymenocallis** species arranged by area of location with somatic chromosome numbers where known.

UNITED STATES

henryae Traub (W. Fla.)—38	**latifolia** (Mill.) Roem. (Fla. Keys)—48
crassifolia Herb. (S.E. U.S.)—40	**caroliniana** (L.) Herb. (S.E. U.S.)—52, 54
galvestonensis (H.) Baker (S.W. U.S.)—40 (42)	**Eulae** Shinners (S.W. U.S.)—52
palusvirensis Traub (N.C.)—40	**occidentalis** (LeConte) Kunth (S.E. U.S.)—54
rotata (K-G) Herb. (S.E. U.S.) 40 (42)	**kimballiae** Small (W. Fla.)—70
Palmeri Wats. (Fla.)—42, 46, 48	**choctawensis** Traub (W. Fla.)
coronaria (LeConte) Kunth (S.E. U.S.)—44	**pygmaea** Traub (S.C., Ga.)
floridana (Raf.) Morton (Fla.)—46	**moldenkiana** Traub (Ga.)
puntagordensis Traub (Fla.)—46	**traubii** Moldenke (Fla.)
	duvalensis Traub (Fla.)

MEXICO

1. **acutifolia** (Herb.) Sweet (Jalisco, Michoacan, Morelos, Nayarit, Oaxaca, Tamaulipas) -46
2. **azteciana** Traub (Jalisco, Nayarit)
3. **choretis** Hemsley var. **choretis** Traub (Morelos, Nayarit)—42
4. **choretis** Hemsley var. **oahacensis** Traub (Puebla)—84
5. **cordifolia** Micheli (Guerrero) 46
6. **dryandri** (K-G) Sweet (Vera Cruz) 46
7. **eucharidifolia** Baker (Hidalgo, Nayarit, Sinaloa)—44
8. **galvestonensis** Herb. (Baker) (At least some Mexican specimens so labelled are **choretis.**)

9. **glauca** Roem. (Guerrero, Oaxaca, Puebla) 84 (near **choretis** var. **oahacensis**)
10. **graminifolia** Greenman (Chihuahua, Morelos, Tlaxcala)—60
11. **harrisiana Herb.** (Mexico, Michoacan, Morelos, Puebla) 84, 86
12. **horsmannii** Baker (Jalisco, Nayarit, Vera Cruz)—42
13. **jalicensis** M.E. Jones (Hidalgo, Jalisco)—88
14. **littoralis** (Jacq.) Salisb. (Mexico, Michoacan, Oaxaca)—46
15. **mexicana** (L.) Herb. ex Druce Hidalgo, Michoacan, San Luis Potosi)—46
16. **ovata** (Mill.) Sweet (Oaxaca) (U. Cal. specimen)
17. **pedalis** Herb. (Vera Cruz)—46
18. **repanda** Otto & Dict. (Sinaloa)
19. **riparia** Greenman (Michoacan, Morelos) 46
20. **sinaloaensis** Traub (Sinaloa)
21. **sonorensis** Stand. (Sinaloa, Sonora)—48
22. **speciosa** Salisb. (see Traub 1962)

Additional Taxa Reported by Howard and by Bauml

23. "**Hanniballii**" (see Bauml, 1972 trip) (Colima, Nayarit)
24. **leavenworthii** (Sinaloa) (much like **acutifolia**)
25. sp. nova (Colima)
26. sp. nova (Mexico)
27. sp. nova (dwarf form) (Colima)
28. sp. nova (Guerrero)

Other Names Encountered on Mexican Specimens

29. **adnata** Herb. (Michoacan) (=**H. littoralis** Salisb.)
30. **concinna** Baker (Kew specimen annotated=**H. dillenii**)
31. **crandallii** (Yucatan) (Nat. Herb. specimen)
32. **dillenii** Roem. (Jalisco, Mexico, Michoacan) (=**mexicana** (L.) Herb. ex Druce)
33. **lacera** Salisb. (Yucatan) (N.Y. Bot. Gard. specimen. Introduced?)
34. **longibracteata** Hochreutina (Vera Cruz)
35. **riposia** Greenman (Morelos)

MIDDLE AMERICA

guatemalensis Traub (Guatemala)
littoralis (Jacq.) Salisb. (Costa Rica, Guatemala, Panama)—49
ovata (Mill.) Sweet (San Salvador) 54
ovata (Mill.) Sweet var. **ornata** (Roem.) Traub (Guatemala)
riparia Greenman (Guatemala) (Kew specimens)
Skinneriana Herb. (Guatemala) (=**H. ovata** (Mill.) Sweet)
tenuiflora Herbert (Guatemala)

WEST INDIES
(and Bermuda)

arenicola Northrop (Bahamas, Haiti, Jamaica)—48, 50
caribaea (L. emend Gawl) Herbert (Antigua, Barbados, Cuba, Haiti, Jamaica, Martinique, Puerto Rico, St. Croix)—46
caymanensis Herbert ("probably=**caribaea**" Baker) (Cuba, Haiti, Jamaica, Little Cayman, Trinidad)
crassifolia Herbert (near **caribaea** (L. emend. Gawl) Herb.) (Bahamas. Introduced?)—40
declinata (Jacq.) Sweet (=**caribaea** (L. emend. Gawl) Herb.) (Bahamas, Bermuda, Cuba, Puerto Rico, St. Croix)
expansa (Herb.) Herbert (Bermuda, Haiti, Martinique, Puerto Rico, St. Croix)—46
fragrans Salisb. (Barbados, Jamaica, St. Catherine's)
guianensis (Ker.) Herb. (=**tubiflora** Salisb.) (St. Kitts, Trinidad)
latifolia (Mill.) Roemer (Cuba, Grand & Little Caymans, Haiti, Jamaica, St. Thomas)—46, 48
ovata (Mill.) Sweet (Cuba)—54?
ovata (Mill.) Sweet var. **ovalifolia** (Herb.) Traub (West Indies)
praticola Britton & Wilson (Cuba)
speciosa Salisb. (Jamaica, Tobago, St. Vincent)—98, 195
stenophylla Urban (=**praticola** B. & W.) (Cuba)
tubiflora Salisb. (Trinidad. Also cult.: Jamaica, Tobago, etc.)

Fig. 9. Distribution of **Hymenocallis** species in Southeastern United States.

area of occurrence is listed, followed by the somatic chromosomes number where known. The species of the United States are essentially listed in ascending order of their somatic chromosome numbers - so far as known. Those from other areas are arranged alphabetically.

The bases for Table 1 have been: (1) the study of specimens from herbaria designated by Holmgren and Keuken (1974) as follows: BH, BM, Duke, E, F, Flas, FSU, GA, GH, K, LL, MO, NCU, NY, SMU, UC, US, VSC, WWF (and perhaps a few others); (2) personal field collections and observations; (3) the works especially of Herbert (1837), Baker (1888), Sealy (1954), and Traub (1962) - as well as some more general works such as those of Small (1933) and of Long and Lakela (1971); (4) articles by such prominent collectors of this genus as Mrs. K. Clint, Dr. Thad Howard, Dr. James Bauml, etc., of their various Mexican trips, with the mention of localities where species have been collected, or where new taxa have been secured. Some of these latter have been described by the collectors, by Dr. Hamilton P. Traub, or by others as new species; and (5) any other source furnishing information on species distribution.

1. IN THE UNITED STATES

It will be noted that 19 different species are listed as occurring in the United States. Not included on the United States list is *H. caribaea* which has apparently been introduced from the West Indies and become established at several places, especially along the Gulf Coast. The names of such taxa as *H. caymenensis, H. collieri, H. keyensis, H. lacinata, H. tridentata* - and perhaps one or two others - are also omitted because of apparently being synonymous with certain species in the list presented.

Figure 9 indicates the approximate distribution of *Hymenocallis* in the Southeastern United States. Distribution of the genus is heaviest towards the east, and extends westward into the eastern portions of Texas (Fig. 11) and Oklahoma, and follows the Mississippi River drainage basin from Louisiana and Mississippi into Arkansas, Missouri, Tennessee, Kentucky, Illinois and Indiana (Fig. 9). The genus is known from 15 states (and at least 129 counties) in the indicated areas.

1A. FLORIDA

Many more *Hymenocallis* representatives are known from Florida than from any other state. Figure 10 has numbers, indicating the taxa listed to the left of the map, in the counties of Florida from which collections of these have been made. In addition to the distributions indicated in Fig. 10, unidentified specimens are also available from Washington and Hendry Counties, Florida. *Hymenocallis* species have been reported from 34, of the 67, counties of Florida - and probably occur in additional counties.

Hymenocalis Palmeri is of particular interest. It was one of two single-flowered species described from south Florida by Sereno Watson in 1888. The second species *H. humilis* has apparently never been satisfactorily isolated from *H. Palmeri,* and in recent years taxonomists have

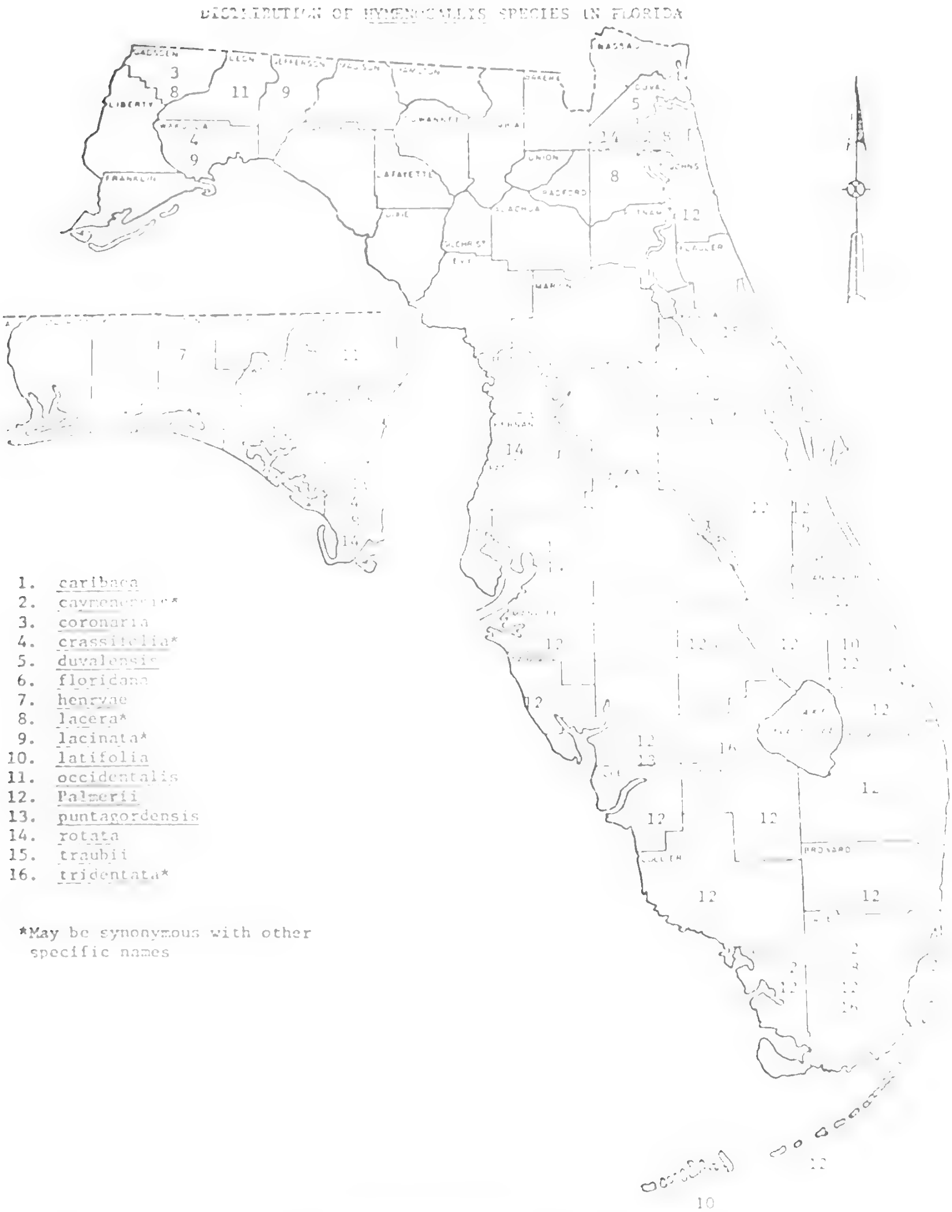

Fig. 10. Distribution of **Hymenocallis** species in Florida.

apparently come to consider the two as more or less synonymous. Single-flowered *Hymenocallis*, apparently *H. Palmeri*, are known from at least 18 south Florida counties, as well as from Johns County further north (see Fig. 10). The single-flowered taxa are found on several of the Keys, and in all counties touching the Atlantic from Dade north to

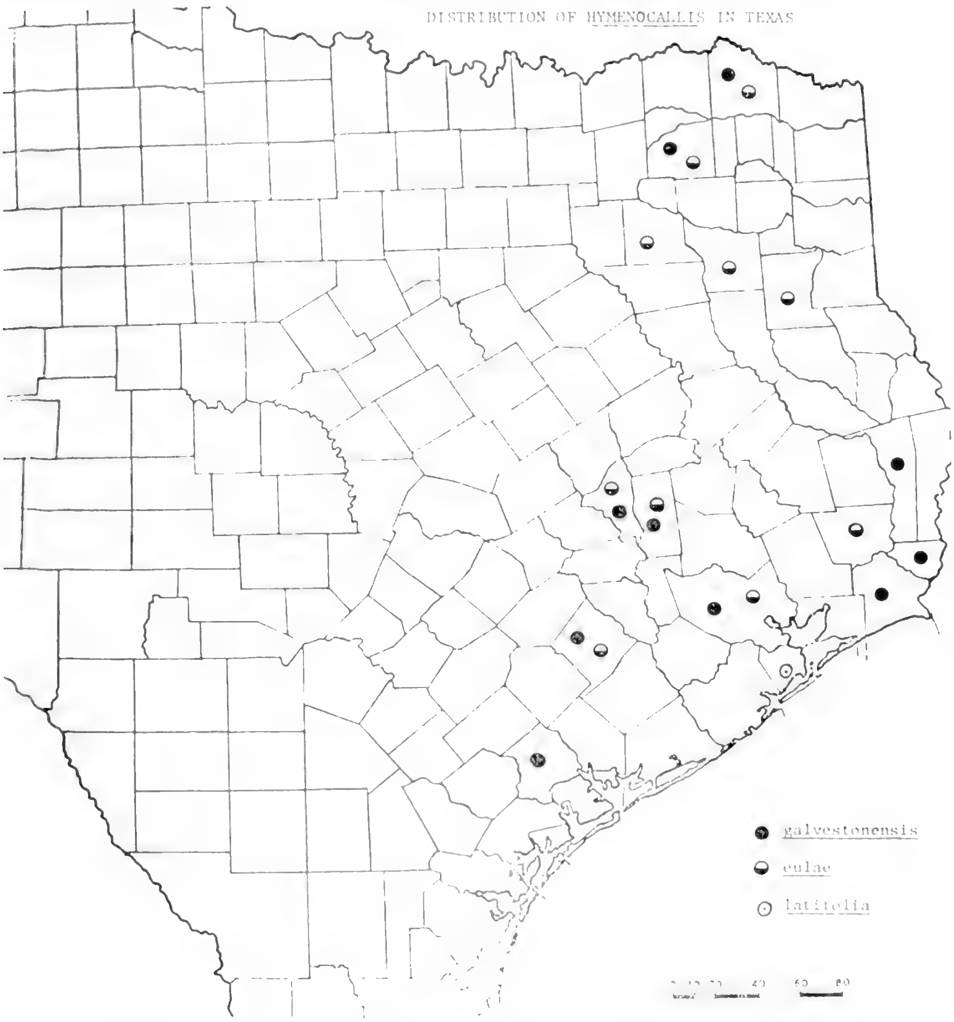

Fig. 11. Distribution of **Hymenocallis** species in Texas.

Brevard. On the Gulf Coast these occur in all counties from Monroe north to Hillsborough. In addition, herbarium specimens are found from four inland counties - Hendry, Highlands, Okeechobee and Osceola. As indicated in Table 1 (*H. palmeri*), three different somatic chromosome

numbers have been encountered for these single-flowered forms, and this from rather limited sampling. More extensive morphological and cytological studies of these may show that more than one single-flowered taxon is present in south Florida.

1B. TEXAS

The known western distribution of *Hymenocallis* is shown in Fig. 11. Specimens from 15 different Texas counties are found among the herbarium specimens studied. Practically all of these specimens are either of *H. galvestonensis* (Herb.) Baker or *H. Eulae* Shinners. While these two taxa often grow in the same areas, they occupy different habitats, and have some sharp differences. The two forms will often leaf out at approximately the same time, at similar latitudes and elevations. However, *H. galvestonensis* usually grows in mucky areas, *H. Eulae* in dry friable soils. The former flowers soon after leaves appear in the early spring, and it has 40 metacentric somatic chromosomes. The latter flowers, from naked scapes, in the late summer and has 52 somatic chromosomes, 12 of which are telocentric. *H. galvestonensis* is known to occur in southeastern Oklahoma, and it would not be surprising to find *H. Eulae* in the same area. The former, at least, occurs fairly widely in Louisiana.

A third species, *H. latifolia,* is sometimes found in the general area of Galveston. This, however, is essentially a West Indian taxon and has probably been introduced into Texas.

1C. NORTH CAROLINA

Distribution of *Hymenocallis* is also presented, in Fig. 9, for North Carolina - the state in which the author lives.

The species indicated by Radford, Ahles and Bell (1968) as *H. crassifolia* Herbert occurs in 5 of the southeastern counties of the state, as indicated in Fig. 9. *Hymenocallis palusvirensis* Traub was collected near Supply in the most southeastern county of the state, Brunswick. *Hymenocallis rotata* (Ker Gawl.) Herb. which is usually found further south, in South Carolina and Georgia, has been collected in Cumberland County in the southeastern part of the state.

A fourth species, *H. coronaria* (LeConte) Kunth, which is found along, and often in, the rivers of the southeastern states, has been collected in the Catawba River in Gaston County. Its bulbs were nestled between rocks just below the water surface, with its strong roots twined firmly around the rocks. This is the furthest north that this species has been noted.

2. IN MEXICO

The country of Mexico is especially rich in *Hymenocallis* taxa which are presently known. Moreover, every extensive collecting trip into the country seems to yield additional, undescribed, species. Taxa are now known from 18 (of Mexico's 29) states, as well as from the Federal

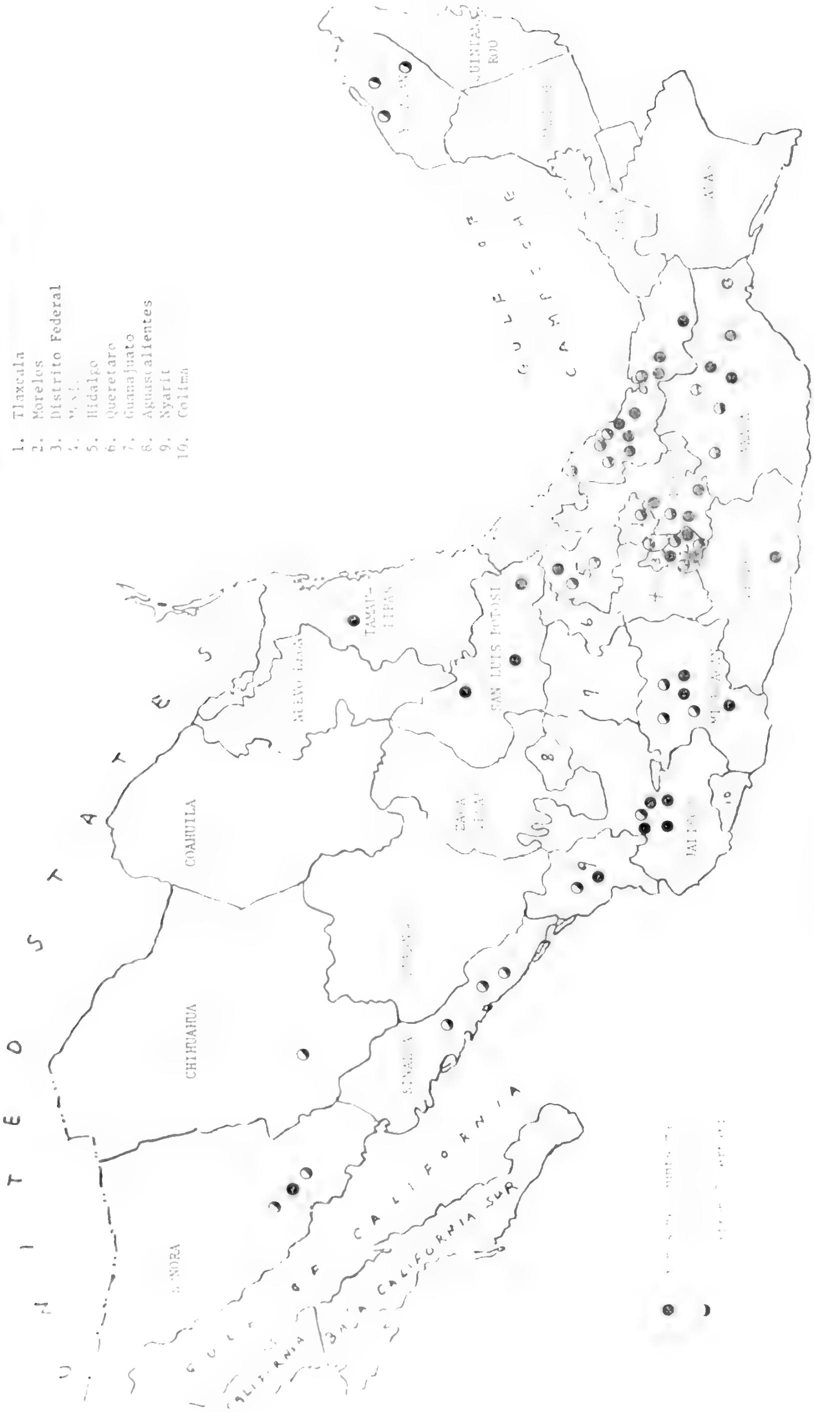

Fig. 12. Distribution of **Hymenocallis** species in Mexico.

District. It is likely that further exploration will reveal an even wider distribution of *Hymenocallis* in Mexico.

Fig. 12 indicates the general known distribution of Mexican *Hymenocallis,* with the half-darkened circles indicating herbarium specimens observed, and the full-dark circles indicating approximate collection points of taxa which have been studied cytologically (Flory, 1976). This map indicates taxa known from 17 states and the Federal District. The map was prepared prior to some of Dr. Howard's and Dr. Bauml's reports which include several species from an eighteenth state, Colima.

In Table 1 are listed the names or designations of *Hymenocallis* reported from Mexico, with known states of occurrence, and any reported chromosome numbers. Geographically, the table and Fig. 12 show a good correlation. The table does list several taxa from Colima, which are not indicated on the map for reasons already explained.

Of the 35 taxa listed for Mexico in Table 1 the first 22 species listed are fairly well accepted. A few exceptions may be noted. *Hymenocallis pedalis* Herb. is usually listed as from further south than Mexico, but specimens collected from apparently native habitats in Vera Cruz cannot be easily differentiated from the herbarium specimens of this species, and apparently represent an extension of its range. Again, *H. choretis* Hemsley var. *choretis* Traub and *H. choretis* Hemsley var. *oahacensis* Traub may very likely represent diploid and tetraploid forms of essentially the same taxon. Further, it is possible that *H. glauca* Roem. is merely a synonym for *H. choretis* Hemsley var. *oahacensis* Traub (as some authors indicate), although there are slight differences in leaf, flower, and glaucousness between plants suggestive of two similar but different taxa. *Hymenocallis ovata* is usually considered an entirely West Indian species; however, there is an apparently unquestionable specimen of this species in the University of California Herbarium marked as coming from Oaxaca. Could this possibly be an introduction into Mexico? Regardless of how the questions concerning the several species discussed in this paragraph are answered, there is no question but that a considerable number of native Mexican species of *Hymenocallis* are known and generally accepted.

In addition, recent reports by Howard and by Bauml (1977, 1976 and earlier) mention the taxa, numbered in Table 1 from 23 through 28, as apparently new and different species. It seems likely that some or all of these will be described and added to the Mexican constituents of the genus in due time.

Then finally, in Table 1 (Nos. 29 through 35) are listed seven names, most if not all of which are synonymous with some of the first 22 names in the Mexican list. Since these names are still encountered from time to time, they are added here for attempted completeness.

It is evident that at the present time the majority of the presently known Mexican *Hymenocallis* occur (Fig. 12) from near the Pacific - in Sinaloa, Nayarit and Jalisco - then roughly eastward more or less along

or near the 20th parallel (South) through the states of Michocan, Mexico, Morelos, Hidalgo, and Puebla into Vera Cruz. Many populations are also known from the state of Oaxaca. To substantiate this concentration one only needs to study Table 1 to note the number of taxa known to occur in the states mentioned: Sinaloa - 5, Nayarit - 6, Jalisco - 5, Michoacan - 7, Mexico 4, Morelos 5, Hidalgo - 3, Puebla - 3, Vera Cruz - 4, Puebla 3, and Oaxaca 4.

A glance at Fig. 12 confirms the apparent scarcity of known *Hymenocallis* in the area of the great Sonoran Desert. This does not seem promising territory in which to discover many more species of this genus. However, the plateau, mountainous, and perhaps also the lower and more tropical areas of the country, to the south, all seem promising areas in which interested and hard-working collectors may anticipate locating a number of additional *Hymenocallis* species.

3. IN MIDDLE AMERICA

Considering the number of *Hymenocallis* taxa known from Mexico, and from South America, a surprisingly few species of the genus have been reported from Middle, or Central, America. The majority of these are known from Guatemala.

Hymenocallis guatemalensis from Guatemala was recently (1967) described by Traub; *H. tenuiflora* Herbert has long been known from the same country; *H. littoralis* (Jacq.) Salisb. was recently collected in Panama (and bulbs sent to us) by Professor Walter Lewis of the Missouri Botanical Garden; and Dr. Traub (1962) lists *H. ovata* Roem. var. *ornata* Traub as occurring in Guatemala; while *H. ovata* had earlier been reported from San Salvador. Baker (1888) reported *H. Skinneriana* Herbert from Guatemala, but this taxon is apparently not recognized by either Sealy (1954) or Traub (1962). All of these forms are listed in Table 1 for completeness.

4. IN THE WEST INDIES

The West Indies are usually considered as the islands in the Atlantic between Florida and South America, including the Bahamas as well as the Greater and Lesser Antilles. Since a few *Hymenocallis* occur in the Bermuda Islands, some apparently naturally - while others are perhaps introduced, reference is also made here to the Bermudas where taxa are found there.

There are about 9 distinct species found through the West Indies, with a few apparently having distinct varieties. These are listed in Table 1 along with the known distributions available to me. Doubtless several - perhaps most - of these species also occur on other islands from which collections have not been made, or if so the collections of which have not been found recorded by this author. In Table 1 several synonyms are included which are frequently found on herbarium specimens from the West Indies, but which are incorrect names, botanically. Such synonymous names are indicated in the table.

DISCUSSION

It is evident from the above text, especially when considered along with Table 1, that approximately 40 distinct species are now known in North and Middle America and the West Indies. A few of these (from 8 to 10) occur in more than one of the geographical areas discussed. It is also evident that several undescribed *Hymenocallis* species, especially from Mexico, are known, and that these will increase the total number when descriptions are available.

Figs. 9, 10, 11 and 12 indicate the general distribution of *Hymenocallis* in the United States and in Mexico, respectively. The distribution areas in Middle America and in the West Indies, are listed in Table 1 so far as known. These areas, in general, are fairly small and it was thought that additional maps would not add greatly to the distribution picture for these geographical entities.

A number of additional species would be added if the South American species, and the known interspecific hybrids, were taken into account. Traub listed 14 South American species in his 1962 article, and has since described such additional species as *H. venezuelensis*, *H. bolivariana*, *H. limaensis* and perhaps others. Some interspecific hybrids such as 'Sulphur Queen', 'Daphne', 'Festalis', etc., have been in the trade for a number of years. The late Len Woelfle, and other *Hymenocallis* enthusiasts have considerably increased the numbers of these horticultural forms in recent years, and the possibilities from combining the desirable characters of two or more *Hymenocallis* species are just now beginning to be realized, anticipated, and sought after.

The possibilities inherent in Dr. Traub's subgeneric and Alliance arrangement are also just becoming apparent. Among his 6 Alliances of Subgenus Hymenocallis, all 10 species of Caroliniana are natives of this country, while of the 5 or 6 species in Henryae, all but *H. praticola* (of Cuba) are natives of the United States. The 7 or 8 taxa of Alliance Mexicana are all Mexican natives, as might be expected. The situation is somewhat different with the other three Alliances of this subgenus, however. The 5 species of Alliance Littoralis apparently furnish evolutionary links between Mexican, Middle American and South American forms, and also include *H. senegambica* of West Africa, the lone non-American species. The Caribaea Alliance is made up of predominantly West Indian species, but also furnishes links with Floridian, Mexican, Central American and South American forms. And finally, in the Speciosa Alliance are found not only Mexican and South American species, but taxa which furnish genotypic links between (1) Mexican and West Indian; (2) Central American and West Indian; and (3) South American and West Indian taxa.

As these Alliances become clearer, and as more becomes known about the chromosome conditions and correlations in the various Alliances and subgenera, intelligent planning of genetic and horticultural improvement will be facilitated. There will be a broader base for predicting, instead of just guessing, as to the hybrids which should be

possible, and the desirable characters which can probably be combined.

The biogeographers (collectors and students of distribution), the cytologists, the taxonomists, and the hybridizers, along with those interested in other areas—by combining their knowledge and skills can do a much better job of deciphering relationships and improving their plants, than can any single individual or group working alone. This is one of the great advantages of a Society composed of members with basic—but greatly varied—interests in a single plant family.

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Bennett—LEAFHOPPERS ON AMARYLLIS, continued from page 124.

are probably active year-round here. The young have four or five nymph stages before reaching adulthood.

Some questions to consider are these. Do leafhoppers actually feed on amaryllids? Will newly-emerging nymphs feed on the plant where their eggs were deposited? Do they transmit viruses harmful to amaryllids? Are viruses transmitted during the egg depositing process?

NEW **HYMENOCALLIS** SPECIES FROM MEXICO

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I. PROBLEMS IN IDENTIFYING MEXICAN SPECIES

The problems of properly identifying the *Hymenocallis* of Mexico can be intrigueingly frustrating and challenging. To begin with, there are around thirty or so species of this genus to be found, counting the old species and the newly discovered ones. Many of the early species were simply listed for their habitat as "Mexico", with no identifying geographical data given. Those who travel Mexico in quest of plant material know that it is a big country, full of mountains and valleys which helps to isolate species from one another. To simply say that a certain plant is from Mexico is about as helpful as saying it is from the planet earth.

This was the problem in finding *H. eucharidifolia* Baker. We know that this plant existed somewhere in Mexico when it was first described in 1888, but no one seemed to know just where as this information was never given. Sealy stated in his 1954 monograph that it was "described originally from a plant of unknown origin, which flowered at Kew in May 1884, and known from the type material only, namely a single leaf and a scape with one flower and three ovaries." He goes on to state that "so far as number, size, and shape of the leaves is concerned, and their being sessile, *H. eucharidifolia* is nearest to *H. choretis*, but this has a bigger perigone, and the staminal cup is more or less rotate instead of funnel form."

In my early years of collecting Mexican *Hymenocallis*, every new discovery had compared with descriptions of older known species to help in its identification. It soon became apparent that it was easier to find new species than it was to find some of the older known ones. For example, *H. harrisiana* Herbert, though long known and though still found in cultivation, has eluded me right up to the time of this writing. I have visited previous known original habitats, yet have never seen it in the wild. There is the constant reminder that perhaps it no longer exists, at least in these places, as a wild plant, having fallen prey to agriculture.

In 1970, while exploring for plants in Guerrero, a state rich in the number of species in *Milla* and *Hymenocallis*, I chanced to stumble on a *Hymenocallis* of the Mexicana alliance that was quite new to me. Unlike other members of this group with bluish-green (glaucous) foliage, this one had bright green leaves. At this time (early July) it had just finished flowering, and it was not until the following year when it flowered in cultivation, that I was to learn its identity. In reviewing Sealy's monograph I found that it fit *H. eucharidifolia* Baker perfectly, not only in its bright green leaves, but in the shape of its funnel-form staminal cup with erect margins and two teeth between the filaments. The tepaltube was straight and the flowers sweetly fragrant. My

plants first flowered on the 24th of May in 1971. They flowered again in 1972 on the same day. This was a coincidence I thought, and put it out of my mind until I found that the type specimen flowered at Kew, in 1884, also on May 24th!

H. eucharidifolia is endemic to a small area below Chilpancingo, in the state of Guerrero, near the village of Acahuizotla. Compared to other members of the Mexicana alliance, it has to be considered one of the early season bloomers, and if one wishes to collect it in flower, one must go there no later than mid-June. It is the only member of this alliance having broad, thin, Eucharis-like foliage with bright green leaves. The flowers are sweetly scented, unlike *H. choretis*, which is also found there and flowers a month later. There may be 1 to 6 flowers in the umbel. The ovary is sessile, which easily distinguishes it from *H. woelfleana*. The seeds are 1.4 cm long, sharply angled on 2 or more flat planes, rough textured, and are pale dull green. The straight tepal-tubes can be variable in length, ranging from 7 to 13 cm long in individuals. The tepalsegs are shorter than the tube. Pollen is orange.

H. eucharidifolia is quite rare within its limited range, and this partly accounts for its being lost to cultivation for nearly a century. Acahuizotla formerly was just on the old road to Acapulco, but years ago a new road was built that completely bypassed the village. Now one must enter a trail through a gate in order to get to it. It is easily missed.

II. NEW **HYMENOCALLIS** SPECIES FROM MEXICO

Although to the casual eye most *Hymenocallis* species appear similar, the discriminating ameteur collector of these AMERIND LILIES can see subtle differences which escape the non-initiated. It is true that they are almost all white-flowering with one yellow-flowering species, *Hymenocallis* and *amancaes*, a green-flowering species, both native to Peru. The hybridizer could possibly produce yellow flowered hybrids by crossing with the numerous white-flowering species from the southeastern United States, Mexico, Central America, the West Indies and South America.

Milestones in the botany of *Hymenocallis* are few and far between. An excellent historical account of the genus may be found in J. Robert Sealy's Kew Bulletin no. 2, 1954 REVIEW OF THE GENUS HYMENOCALLIS. For practical purposes (and brevity) we might say that R. A. Salisbury (1812) first segregated them from Pancratium and placed them under the genus *Hymenocallis*. William Herbert solidified this position in 1837 in his publication of the Amaryllidaceae. In later years Roemer (1847), Kunth (1850), and Baker (1888) further added their prestigious weight to the position of the validity of the genus. Many decades of nothingness for the genus passed until 1954, when Sealy finally did his needed review. Then in 1962 PLANT LIFE, Dr. H. P. Traub brought the genus up to date for the period. Since then, the finding of several new species has demanded that once more the genus needs further reviewing and that a few revisions be made,

particularly in the species found in Mexico. Some of the species in the Mexicana alliance are fairly common over a wide area covering many states each. *H. choretis,* for example, is found as far West as the state of Michoacan, and as far south as central Oaxaca in a broad band below Mexico City, including the states of Mexico, Guerrero, Puebla, and Morelos. Little wonder that it was one of the first species discovered in this alliance. Likewise, *H. mexicana*, common between Guadalajara and Morelia, is found in Michoacan, Jalisco, and Guanajuato, and is a prominent species along the roadsides. The same may be said for *H. horsmanni* (Jalisco, Nayarit), and *H. sonoriensis* (Sinaloa, Sonora, and Nayarit. These are the so-called "common" members of the Mexicana alliance. They are widespread and are bothered little by grazing and agriculture. If one is looking for *Hymenocallis* of the Mexicana alliance, chances are it will be one of these, depending on the area traveled. There is another group within the alliance composed of endemics, i.e. species confined to a very small geopraphic area and found nowhere else, and it is these that are being introduced for the first time. Some of these are facing extinction, even though so new to science, and there is a good chance that they will disappear within the next decade. The main reason for their eminent demise is the destruction of their habitat for food crops, and the constant overgrazing pressures of livestock . . . cattle, burros, and goats. Already we have very suddenly witnessed millions of *H. durangoensis* covering a huge colony of several square miles, virtually wiped out by the plow. What a pity that these bulbs could not have been dug and sold to bulb dealers, but that is not the way it works. The plant is showy, easy to grow, and makes a fine garden plant and though recently plentiful, it is suddenly rare. Of the four endemics introduced here, only *H. guerreroense* seems temporarily not threatened, but this is subject to change.

While *Hymenocallis* easily show their differences from one another in living material, they can be confusing when examined in the dry state. Part of this is due to distortion and shrinkage. Distortion is easily accomplished in "arranging" the specimen on the blotters in order to properly display them and dry them out as the succulent flowers begin to wilt. What began as a slightly curved tepaltube winds up as a straight one on the dried specimen. Likewise shrinkage of floral parts can make the final result considerably smaller than it was in the living material. In general, the more succulent tissues will shrink at a higher rate than those that are less so. Membranous staminal cups will shrink less than the tepal segs, but the width of the scape will shrink alarmingly from its original size.

Foliage will retain the character of its shape when dried, but will lose an equally important character in that one will not be able to determine if it was originally glossy green, glaucesent, or glaucous. These characters can be most helpful in distinguishing species in living material. The character of the living seed is also very important, but

here again the character is lost when dried. Differences in fragrance, while real and useful in species differentiation in flowering live material, are of no value in a dried specimen. These differences are admittedly subjective, but still it is hoped that a student with normal olfactory senses can perceive the differences in odors of flowers having the smell of new-mown-grass, or chlorine bleach, or a spicy-sweetness.

NEW **HYMENOCALLIS** SPECIES FROM MEXICO

HYMENOCALLIS NAYARITIANA T. M. HOWARD, **SP. NOV.**

Species a H. horsmanni praecociore florente foliis latioribus aspritexturis atriorviridibus floribus jucunde odoratis tubo tepalorum curbato distinguenda.

State of Sinaloa, e. Mazatlan, Mexico. 1964. TRA 1165, 1166 (paratypes); n. of Tepic, Nayarit. 1964. TRA 1167 (isotype), 1168 (type). Fig. 13.

Bulb: small, brown coated, 2-4 cm broad, 4 cm long, globose. *Leaves:* 4-5, 10-19 cm long, 2½-4½ cm wide, narrowly elliptic, sessile to subpetiolate, to petiolate; suberect to prostrate, spreading, acute to subcuspidate, glaucescent. *Scape:* 14-30 cm tall, round in cross-section, umbel 1-5 fld.; *Fls.* white, suberect, tepalsegs spreading, 5.5 cm long, 5 mm wide, florets straight in bud, tepaltube curved slightly at flowering; Odor: slightly sweet smell of new mown grass. *Ovary* sessile, *seeds:* dark dull green, rough textured, sharply angled, 2-3 per capsule, 1 cm long. *Tepaltube:* 5-6 cm long, curved slightly, greenish white near base; *Staminal cup:* funnel shaped with tubulose base, 2 cm long, 2¼-2½ cm wide minutely denticulated between the filaments; *Filaments:* 2 cm long, white at staminal cup base, then becoming green; *Anthers:* 1 cm long, versatile, *pollen* orange colored.

Grown from bulbs collected by T. M. Howard a few miles north of Tepic, state of Nayarit, Mexico on Mexico 15, flowering June 29, 1964, in a mixed colony containing newly emerging plants of *H. horsmanni*. It flowers in San Antonio in May, at least a month in advance of *H. horsmanni*, and it is one of the first of the Mexican alliance to flower. It is one of the dwarfer species in the mexicana alliance. *H. nayaritiana* can easily be distinguished from *H. horsmanni* by its flowering much earlier, its low spreading, broader foliage, more pleasantly sented flowers with curved tepaltubes, and seeds that are fewer in number per pod, and rougher textured and darker green in color. The round stem (cross-section) easily distinguishes it from those having compressed stems. It is common in early summer north of Tepic, Nayarit on the roadside and hillsides, but is difficult to find after flowering as it goes dormant very early, and is overgrown by weeds, whereupon *H. horsmanni* becomes the dominant *Hymenocallis* species in the area. *H. nayaritiana* can flower from very small bulbs (½″) and with *H. graminifolia* comprises one of the smallest members of the mexicana alliance.

HYMENOCALLIS QUERREROENSIS T. M. HOWARD, **SP. NOV.**

Planta foliis glaucis a speciebus similibus in Consanguinitati Mexicanae tubo tepalorum recto distinguenda.

State of Guerrero, Mexico, n. Chilpancingo, 7-24-73. TRA 1174 (type).

Fig. 13. **Hymenocallis nayaritiana** T. M. Howard. **sp. nov.** Photo by James A. Bauml

Collection # 73-27- T. Howard, July 1973 in leaf after flowering. Flowered in San Antonio in early May, 1975 from collected bulbs. Native to mountains of south-central Guerrero, Mex.

Bulb: subglobose, brown coated, ca 5 cm long and 4 cm wide. *Leaves:* 3 to 5, narrowly linear-elliptic, sessile 26 to 35 cm long, 1.5 to 2.5 cm wide at the middle, 0.5 cm wide at the base, acute, glaucous, with

keel. *Scape:* 30 to 35 cm, oval 2-edged, 5 mm wide below the umbel, slightly wider below. *Flowers* white, sweetly fragrant, 1 to 3 in number in few fld umbel. *Spathe valves:* 2 in number, lanceolate, acute, 3 to 4 cm long, 0.5 cm wide at base of umbel, bracteoles slightly smaller. *Flowers:* Tepalsegs: linear acute, 6.5 cm long x 6 mm wide, spreading. *Staminal cup:* rotate, margins spreading, 2 cm long x 3 cm wide, from short tubulose base. *Tepaltube:* straight, greenish in lower 3/4, white above; 7.5 cm long. *Staminal cup:* toothed between the filaments; 2 cm long, 1 cm wide at apex. *Filaments:* 2½ to 3 cm long, greenish; *Anthers:* versatile, *pollen* orange-yellow. *Ovary:* sessile. Seed 1.3 cm long x 1 cm wide, smoothe, shiny lt. green. Polyembryonic.

Notes: State of Guerrero, NW of Chilpancingo on road to Puerto el Gallo. *H. guerreroensis* is named for the state in which it grows. It seems to be endemic to a mountainous area on a new road, west from Mexico 95, n. of Chilpancingo. It is a very early flowering member of the Mexicana alliance with typically small flowered; umbel of flowers having straight tepaltubes. The flowers are sweetly fragrant. Several trips through its habitat in mid July always finds them becoming dormant, and to find them in flower one must go to that area at least a month earlier. It likely flowers with the first rains in that area. *H. guerreroensis,* with its straight tepaltubes, can easily be differentiated from those of the Mexicana alliance having curved tubes, which are more or less similar, such as *H. mexicana, H. durangoensis,* and *H. graminifolia.* The more or less narrow glaucous foliage is another character that easily separates it from other species found in that area. First flowered in cultivation in San Antonio, Texas May 7, 1974.

HYMENOCALLIS DURANGOENSIS T. M. HOWARD, SP. NOV.

Species scapo bimarginato foliis sublinearibus vivide viridibus in dimidio superiore spiralibus, tubo tepalorum curvato quam hunc H. mexicanae dimidius longiori distinguenda.

State of Durango, Mexico, e. Durango City, 6-28-64, TRA 1175 (type), TRA 1176 (isotype).

Bulb: globose with blackish-brown skins, ca 5 cm wide and 4 cm long, with short neck. *Leaves:* 5 to 6, sessile, erect, bright green, spiraling in upper half, linear-lanceolate, acute, 2½ cm wide at the middle, narrowing to 1½ cm at the base, 25 to 40 cm long, prominently keeled; deciduous. *Scape:* as long as the leaves, 25 to 40 cm long, ca. 1 cm or more broad at the base in living material, glaucescent, oval in cross section, but distinctly two edged. *Spathe-valves:* (2)-4 to 5 cm long, 4-5 mm wide, lanceolate, acute. *Umbel:* 4 to 12 flowered, white except lower part of tepaltube green, and upper half of filaments and style green. *Tepalsegs:* 6 to 7 cm long, 5 mm wide, linear acute, spreading; florets straight in the bud, *tepaltube* curved in upper 1/3rd on flowering, 6-7 cm long; *Staminal cup:* funnel-shaped from a short tubulose base 2 to 2½ cm long, margins erect, minutely denticulated between the filaments, 2½ to 3 cm wide. *Filaments:* 2-3 cm long above the free portion, green, straight, spreading outward; *Anthers:* 1½ cm long,

versatile, *pollen* orange yellow; *style:* overtopping the filaments; *Ovary:* sessile; *Seeds:* 2 cm long x 1.5 cm wide, lt. dull green, smoothe surfaces. Floral scent: not especially pleasant, chlorox-like.

Notes: Collected in flower June 28, 1964, about 30 miles east of Durango City, Durango, Mexico, on Mexico 40. Endemic in a fertile valley in rich black soil, wet in summer and dry in winter, growing at an elevation of around 6000 feet. Now an endangered species. Fields once abundant with huge colonies of tens of thousands of *H. durangoensis* now have fallen to the plow and grow only food crops, such as corn. One colony was nearly a mile wide and a half mile deep, a sheet of white when it flowered. These are suddenly all gone, never to return again.

H. durangoensis differs from other members of the Mexicana alliance with nearly linear leaves in that the foliage is bright green and spirals in the upper half. The other narrow leaved species have glaucous foliage. The tube of *H. durangoensis* is curved, like that of *H. mexicana*, but is half again longer, and its stem is two-edged rather than round as in *H. mexicana*. *H. durangoensis* lacks the straight tube of *H. sonoriensis*, and the sweet fragrance of that species. While *H. graminifolia* is relatively few flowered (1 to three, rarely four), *H. durangoensis* has four to twelve flowers with curved tubes.

In cultivation, *H. durangoensis*, given enough moisture in rich soil in full sun, can produce up to three scapes in a single season from largest bulbs. I have chosen to name it for the state of Durango, where it is known to occur as an endemic in one valley about 30 miles East of the capital, between the villages of F. I. Madero and Guadalupe Victoria.

HYMENOCALLIS WOELFLEANA T. M. HOWARD, SP. NOV.

Species a speciebus allis in Consanguinitati Mexicanae ovario pedicellato et polline flavo distinguenda.

State of Sinaloa, Mexico, e. Santa Lucia, 6-28-64. TRA 1178 (type).

Bulb: globose, blackish-brown coats, when cut in half, the inner central tunics are white, while the larger outer tunics are colored orange beneath the bulb coats. *Leaves:* petiolate to subpetiolate, 3-6 in number, bright green, thin, keeled, with prominent ribs (2) near margins; oblanceolate to elliptic, acute, 5 to 10 cm wide, 30 to 40 cm long. *Scape:* 33 to 58 cm tall, compressed, 6 mm or more wide at base, glaucescent lt. green. *Umbel* 3-10 fld. *Spathe-valves:* lanceolate, white 4 cm long, 4 to 5 mm wide, becoming vestiges shortly after the scape emerges between the leaf blades and leaving the buds nakedly exposed well before flowering. *Flowers:* white, fragrant, *tepaltube* straight in bud stage, but may be straight or curved on flowering, greenish in lower half, white in upper half, 6 to 7 mm long, *Tepalsegs* 5 to 6.5 cm long, 6 to 7 mm wide, spreading and recurving slightly in outer 1/3rd. *Staminal-cup:* funnel form, crinkled texture, with margins erect or rotate and spreading in some, from short tubulose base, 1½ to 2 cm long and 2½ cm wide. *Filaments:* 2 cm long, white in lower half, greenish in upper

half; ***Anthers:*** 7 mm long, versatile, *pollen* yellow to orange-yellow. ***Ovary:*** on 4 mm long pedicles; 2 ovules per cell; ***Seeds:*** dark green, 1.6 cm long and 1.2 cm bread, with brain-like convolutions, rough, tortois-shell form.

Notes: H. woelfleana is endemic to the western slopes of the Sierra Madre mountain range in the eastern part of the state of Sinaloa, Mexico, in part shade, at intermediate altitude, in a western sun exposure in Oak and other hardwoods, growing in rich soil with much humus on slopes under trees and along rivulets that intermittantly carry water after each shower during the rainy season. When the rains end in early fall, this area is dry until the summer rains begin again. *H. woelfleana* is a deciduous species with a short growing season and is most closely related to *H. cordifolia* from the state of Guerrero, and likely grows under similar conditions. Both *H. woelfleana* and *H. cordifolia* have been assigned to the Speciosa alliance because of their petiolate foliage and pedicled ovaries. To this we might add their yellow pollens. Pollens of the Mexicana alliance are orange-yellow or orange. Both *H. woelfleana* and *H. cordifolia* have the deciduous habits of the mainstream Mexicana alliance and thus lie midway in many respects between the Speciosa and Mexicana alliances, but leaning toward the former.

The foliage of *H. woelfleana* would easily separate it from the unique foliage of *H. cordata*, and geographically they are widely separated. *H. woelfleana* can be easily distinguished from other members of the Mexicana alliance by not only its yellow pollen, but by the presence of a pedicle below the ovary. The Mexicana group have orange pollen and are sessile. The seeds of *H. woelfleana* are very dark green, shaped like a tortoise, and convoluted in a brain-like fashion, quite different from the Mexicana group. The bulb is unique too. Beneath those blackish-brown outer coats is an orange and white bulb. The central half is the usual white, but the outer half is orange. At first I thought this might be a cultural illness, but I have repeatedly cut into bulbs during many collections, and I find this to be the norm. Unlike most other species, *H. woelfleana* has not shown itself to ever produce offsets, either in the wild or in cultivation. It can only be propagated by seeds. Bulbs cut up for propagation only die.

Since first discovering it in 1964, I have since observed its habitat progressively decimated by agriculture and livestock. It is now an endangered species and likely may become extinct in a matter of a few more years.

I am pleased to name this new species in honor of the late Len Woelfle, former Chairman of the Pancratiodeae committee of the APLS, and *Hymenocallis* breeder. Mr. Woelfle did much to encourage interest of *Hymenocallis* in this country, at a time when they were being largely ignored. He introduced many new *Hymenocallis* hybrids, some of which are now widely cultivated by those few enthusiasts who love them, such as 'Pax', 'Helios', 'Icon', 'Buckeye', 'Dancing Doll', 'Ballerina', and 'Jack Frost'. Len closely kept abreast of my exploration trips and were he alive today, many of the new species that I found would

have been incorporated into his own hybrids.

H. woelfleana is not for everyone. It is very beautiful, but rare and not easy. I can't keep it in the ground, but have had to grow it under greenhouse conditions. It has a short growing season and a long dormant period. It will not tolerate a cold winter situation, even in the lower south. Propagation is only by seed. It loses its roots annually so it can be dug and stored if desired. It makes a fine pot plant.

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PLANT LIFE LIBRARY—continued from page 46.

THE RECENT CHEMISTRY OF NATURAL PRODUCTS, INCLUDING TOBACCO, edited by Nicholas J. Fina. Phillip Morris, Inc., Research Center, Richmond, Va. 1976. Pp. 176. Illus.—This is the second volume in the series of the Phillip Morris Science Symposia, held on Oct. 30, 1975, in which a number of outstanding research scientists from the United States and Great Britain partcipated. The fields covered included Alkaloid Synthesis; biosynthesis and steriochemistry of terpenoids and steroids; reaction mechanisms in the burning cigarettes; photosynthesis as a resource for energy and materials; isotopic labels in biosynthetic studies, and the Plant Kingdom: a virgin field for new biodynamic constituents.

PYRETHRUM FLOWERS: Third Edition, 1945-1972. Edited by R. H. Nelson. McLaughlin Gormley King Co., 8810 10th Ave., North, Minneapolis, Minn. 55427. 1975. Pp. (i - vi) + 149. Illus.—This is the third in a series on **Pyrethrum** research. It is concerned with the sources of **Pyrethrum** flowers, the chemistry of pyrethrins and pyrethrinoids; the chemical analysis and biological evaluation of pyrethrum; the manufacture of pyrethrum extract; toxicology and pharmaclogy of Pyrethrum extract; and **Pyrethrum** culture. A list of references and an index complete the volume. This book is an indispensible addition to the literature on **Pyrethrum,** and is very highly recommended.

NATURAL HISTORY IN AMERICA, FROM MARK CATESBY TO RACHEL CARSON. By Wayne Hanley. Quadrangle/New York Times Book Co., 3 Park Av., New York City 10016. 1977. Pp. i-xii + 339. Illus. $14.95.—This is a fascinating popular account of the workers in the field of natural history in the United States beginning with Mark Catesby and progressing to the conservation-minded Rachel Carson in recent times. It is highly recommended to all interested in natural history and the conservation movement.

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CONTRIBUTIONS TO SOUTH AMERICAN AMARYLLIDACEAE VII

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ABSTRACT

New species of South American Amaryllidaceae are described. These are: **Stenomesson microstephium, Rauhia staminosa, Urceolina corynandra, Griffinia rostrata, G. aracensis, Habranthus maasii, H. amoenus, H. steyermarkii, H. nullipes, H. leptandrus, Amaryllis curitibana**, and **A. leucobasis**.—The nomenclature of the species improperly known as **Urceolina peruviana** (Presl) Macbr., is cleared up. The seed morphology of the species reveals that its correct placement is in **Stenomesson**, as **S. miniatum** (Herb.) Rav. comb. nov.—**Coburgia splendens** Herb. is restored and transferred to **Stenomesson.—Havlockia cochabambensis** Card. is placed in **Zephyranthes**, as **Z. cochabambensis** (Cárd.) Rav. comb. nov.—**Z. cutleri** Cárd. is recognized as a **Pyrolirion** species, and the new combination **P. cutleri** (Cárd.) Rav. comb. nov., is proposed. In this connection, the fruit and seed morphology is considered as diagnostic at the genus level.—**Zephyranthes stellaris** Rav., and **Habranthus carmineus** Rav., are reported for the first time respectively in the floras of Brazil, and Uruguay.—The new combination **Habranthus microcarpus** (Rusby) Rav. comb. nov. (**Atamosco microcarpa** Rusby), is established.—**Amaryllis curitibana** Rav., sp. nov., from Paraná Brasil; **A. leucobasis** Rav., sp. nov., from Goiás, Brasil; and **A. argentina** forma **rosea** f. nov. Rav., from Tucumán, Argentina, are proposed.

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I. STUDIES IN THE GENUS *STENOMESSON*

A new species and new combinations from Peru and Bolivia are included. The species wrongly known as "*Urceolina peruviana* (Presl) Macbr.," is recognized as belonging to *Stenomesson*, its proper name being *S. miniatum* (Herb.) Rav. A discussion on the identity of *S. coccineum* (R. & P.) Herb., and new synonyms for several species are also included.

1. THE PROPER NAME FOR **URCEOLINA PERUVIANA** **STENOMESSON MINIATUM** (HERB.) RAV., COMB. NOV. FIG. 14

Pentlandia miniata Herbert, Edwards' Bot. Reg. 25: tab. 68, 1839.—*Spherothele coccinea* Link, Klotzsch & Otto, Icon. Pl. Rar. 2: tab. 38, 1842.—*Urceolina miniata* (Herb.) Bentham et Hooker f., Gen. Pl. 3 (2): 732, 1883.—*Urceolina peruviana* (Presl) Macbride, Field Mus. Nat. Hist. Publ. Bot 11: 11, 1931 (as to the plant described, but not as to name).

This species, since Herbert, has had some important features, and its systematic position, misinterpreted. This author erected for it the genus *Pentlandia* and, mainly because of the supposed lack of a staminal cup, he placed it in the group he called "*Oporanthiformes*".

Fig. 14. **Stenomesson miniatum (Herb.)** Rav.; inflorescence; from a bulb collected in the valley of Sorata, Bolivia. Photo P. Ravenna

It must be noted, however, that actually the flower possesses a staminal cup. The latter appears as totally adnate to the concrescent portion of tepals that gives to the perigone its ventricose aspect. It is possible to note six large teeth alternating with the filaments (see Fig. 14). (Diagnostic figure in 1979 PLANT LIFE.)

Bentham & Hooker f. (1883, p. 732), transfered this species to *Urceolina* due to the same misunderstanding of the morphology. Macbride (1931), followed this concept, believing in the existence of a previous epithet in *Sphcrotele peruviana* Presl, and transferred it to

Urceolina. Two facts induced him to make the mistake: 1. The use by Presl, with a slight variance, of the same genus name proposed by Link, Klotzsch & Otto (1840) for a species that now reveals itself as different. 2. Presl's illustration of *Spherotele peruviana*, based upon a dry specimen, where no cup appears in the detail of the flower.

Some time ago, I obtained on loan the type-sheet of *Spherotele peruviana*, by courtesy of the Národní Muzeum V Praze (Checoslovakia). A flower dissection revealed the existence of a free staminal cup, with six stort teeth alternating with the filaments. This character, along with the size of the ventricose perigone, fits in with *Stenomesson flavum*, a rather frequent species on the coastal hills from Lima to Trujillo, Peru.

The genus *Urceolina*, belonging in the tribe Urceolineae (see Ravenna 1974, p. 71), differs from *Stenomesson*, among other characters, in the few, roundish or ellipsoid seeds in each cell. *Pentlandia miniata* does not produce fruits under culture. Possibly because of some deficiency, the scape, and pedicels, start to dry-up early, preventing the ovary to develop. The fact that wild plants do develop fruits, is demonstrated by the specimens cited here. Personally, I examined plants in flower, and fruit, in the Department of Cajamarca, Peru. The seeds were flat, elliptical-oblong, with membranous edges, like those of *Stenomesson.* On the other hand, the leaves are quite similar as those, for instance, in *S. aurantiacum*, and *S. flavum*, differing from those of the true *Urceolina* species in shape, texture, and less intensity of green. The *Stenomesson* species are, in fact, natives of open areas. The *Urceolina* species, on the contrary, are always found in the rain forest or in shady ravines.

The transference of *Pentlandia miniata*, Herb. to *Stenomesson* seems, therefore, to be well supported.

The species ranges from the Sorata valley, in Bolivia, through the Departments of Cuzco, Apurimac, and Cerro de Pasco, to the region of Cajamarca, in Peru. It varies a little in the northern extreme of its distribution, especially in size, and zygomorphism of flowers. With the exception of Cerro de Pasco, I examined living material in all the mentioned areas, and lately under culture.

Specimens: Peru, dept. Cajamarca, prov. of Chota, above Chota, 2800m leg. Ferreyra 8476, 15-VI-1952, v. n. "moco-moco" (USM), with flowers, capsules, and seeds. Idem, dept. Cerro de Pasco, Paucartambo, 3200m; leg. O. Tovar 1104, 7-VI-1952 (USM). Culta in Bonaria ex bulbis pr. Abancay civit. Apurimac Peruviae collectis; leg. Revenna s/n, IX-1961 (Herb. Rav.). Culta in Santiago Chiliae ex bulbis prope Sorata Boliviae collectis; leg. Ravenna s/n, X-1975 (Herb. Rav.).

2. **STENOMESSON SPLENDENS** (HERB.) RAV., COMB. NOV. FIG. 15

Coburghia splendens Herbert, Amaryll.: 400, 1837.-*C. incarnata* (H.B.K.) Sweet var., Herbert loc. cit.: 400, 1837.

This distinct species has hitherto been mistaken in the herbaria,

and the literature, as *S. variegatum* (R. & P.) Herb. In a recent article by E. T. Di Fulvio (1973), on the caryology of some Amaryllidaceae, the species appears as *S. variegatum.* The latter has broader leaves, and flowers about twice as long ("spithameis", according to Ruiz and Pavón).

Fig. 15. **Stenomesson splendens** (Herb.) Rav., as photographed in the mountains of Calla-calla, Dept. of Cajamarca, Peru. Photo P. Ravenna

The original figure, by the hand of Herbert, shows the flowers as erect, as they are in the type material, but this was the result of pressing the latter in an improper position. Although rather variable in size and color, the flowers are always cernuous or declined.

Specimens: Peru, dept, Amazonas, prov. Chachapoyas, arriba de Leimebamba, 2700-2800 m, monte bajo; leg. R. Ferreyra & C. Aceleto 15274, 20-VIII-1963 (USM, Herb. Rav.). Idem ibid Cerros Calla-Calla, east side, 5 km above Leimebamba, on the road, at San Miguel, 2400 m; leg. P. C. Hutchison & D. E. Bennett 4540, 26-III-1964 (USM, UCAL, US, F. NY, MO, K). Idem ibid, 8 km above Leimebamba; leg. P. C. Hutchison & J. K. Wright 5652, 13-VI-1964 (USM, UCAL). Idem ibid; leg. Ravenna et Díaz Celis 2092, 5-VII-1973 (Herb. Rav.). Idem, Leimebamba-Balsas, Jalca de Calla-Calla, 2800 m; leg. Sagástegui, 23-X-1965 TRP 6055). Dept. Cajamarca, Llama, 2200-2700 m; leg. F. W. Pennell, 17-VII-1948 (USM). Idem, Cutervo, 2700-2800 m; leg. R. Ferreyra, 24-VIII-1963 (USM). Idem, between Cutervo and Cochabamba; leg. R. Ferreyra & E. Aceleto 15348, 24-VIII-1963 (USM). Dept. La Liberstad, prov. Huamachuco, Hda. Yanazara, 2800 m; leg. F. Pinillos, 26-III-1961 (TRP 3656). (?). Cult. in Mus. Javier Prado; leg. R. Ferreyra, 14-IX-1971 (USM).

3. ON THE IDENTITY OF **STENOMESSON COCCINEUM**, AND **S. RUBRUM**

Since they were described, respectively by Ruiz and Pavón and Herbert, the identity of *Stenomesson coccineum* and *S. rubrum* have been obscure. Subsequent authors in all cases attributed the former binomial to wrong material. This actually belonged in *S. breviflorum*, *S. flammidum*, or even in *S. flavum*. Concerning *S. rubrum*, it has inadequately been referred to *S. coccineum*. The latter species appears now as destitute of synonymy.

4. **STENOMESSON COCCINEUM** (RUIZ ET PAV.) HERB. (SYNONYMA EXCL.)

Herbert, Append.: 40, 1821.- *Pancratium coccineum* Ruiz et Pavon, Fl. Peruv. et Chil. 3: 54, 1802 (excl. tab. 285).- *Coburgia coccinea* (Ruiz et Pav.) Herbert, Curtis' Bot. Mag. 67: sub tab. 3865, 1841.

A photograph of the holotype of *Pancratium coccineum* Ruiz et Pav. (at Madrid), reveals that it actually differs considerably from the illustration that accompanies the original description of the species. This was already observed by Herbert (1837, p. 199), when examining an isotype at the British Museum. He thought the figure to be a representation of a specimen labelled by Ruiz and Pavon as "*Pancratium rubrum*", and the specimen of *P. coccineum* "a *Phycella* allied to *graciliflora*". This is correct concerning the figure, which truly corresponds to the specimen mentioned. The holotype, however, and probably the isotype too (at BM), is not a *Phycella* but a true *Stenomesson,* apparently belonging in subgenus *Fulgituba*. The linear-ensiform leaves, flower shape, and relatively short filaments (not protruding from the perigone), support this conclusion. The sheet is misdetermined by Krause as *Eustephia coccinea* Cav.

The specimen labelled *Pancratium rubrum* Ruiz et Pav. (BM, type of *Stenomesson rubrum* Herb.), actually represents *Stenomesson flavum* (Ruiz et Pav.) Herb. In this species the perigone varies from yellow to a bright orange. After the flowers are pressed, the latter

color turns red.

What is then *Pancratium coccineum* R. & P. . . ., and which circumstances caused the misdesignation, as this species, of plate 285 of the Flora Peruviana et Chilensis

Looking through the Amaryllidaceae of the Museo Javier Prado of Lima, three sheets from the coastal hills of Lachay, Lupin, and Chancay, strongly attracted my attention. They represented a *Stenomesson* species, of subgenus *Fulgituba;* the first instances of this group occurring in the "lomas" area. The plants looked rather familiar in general appearance, and, after an accurate examination, their identity with *P. coccineum* was ascertained. Some other sheets from the same places belonged in *Stenomesson flavum* (R. & P.) Herb.

It is known that Ruiz and Pavón, with their expedition-staff (artists included), explored the mentioned hilly areas. It is easy then to imagine the collectors gathering there the material lately described as *P. coccineum,* and also the specimens that would be labelled as *P. rubrum*, a binomial that they never published.

Plate 285 of the Flora Peruviana et Chilensis, named as *Pancratium coccineum,* was certainly based upon an already pressed specimen of *P. flavum.* The position of tepals, appearing as contiguous and hiding the staminal cup, support this assumption. In the fresh flowers they are spreading, and the staminal cup is rather apparent and prominent. *P. flavum* is properly illustrated, based upon living material, under plate 284 of the same work.

Years ago (see Ravenna, 1971), I included *Stenomesson peruvianum* Traub under synonymy of *S. coccineum.* The binomial appears now to be a synonym of *S. breviflorum* Herb.

The locality "Tarma", cited by Ruiz and Pavón for *P. coccineum*, was certainly a mistake. Not far from this town, and rather frequent in the whole region, another red-flowered species, *S. breviflorum*, is found. The latter circumstance probably caused the confusion.

All the sheets from Ruiz and Pavón that I have examined, in photograph, deposited in the Instituto Cavanilles (M), British Museum (BM), and Instituto Botanico dell 'Universitá (FI), Florence, bear no locality data. The set from the latter institution, even lack any identification. This leaves ground to assume that a number of the quoted localities in the Flora Peruviana et Chilensis, may be incorrect. A clear instance is found in the *Alstroemeria* species there treated.

Specimens of *S. coccineum:* Perú, dept. of Lima, prov. Chancay, Chancay, loma pedregosa, 300 m; leg. R. Ferreyra 8731, 24-IX-1952 (USM, UCAL). Idem, prov. Chancay, lomas de Lachay, about 90 km N of Lima, and nearly 4 km E of Panamerican highway, 250 m, (fl. orange); leg. R. Ferreyra 191, 12-X-1945 (USM). Idem, cerca de Lupín, loma seca, 350 m; leg. E. Cerrate 797, 12-XI-1950 (USM, Herb. Rav.).

5. NEW SYNONYMS FOR **STENOMESSON RECURVATUM**

Stenomesson recurvatum (R. & P.) Bak.

Baker, Saunders' Refug. Bot. 5: sub tab. 308, 1872.- *Pancratium recurvatum* Ruiz et Pavón, Fl. Peruv. et Chil. 3: 54, tab. 285, f. a. 1802.- *Carpodetes recurvata* (Ruiz et Pav.) Herbert, Append.: 41, 1821.- *Clitanthes macleanica* Herbert, Edwards' Bot. Reg. 25: Misc. 87, 1839.- *Coburgia macleanica* (Herb.) Herbert, loc. cit. 28: Misc. 55, 1842.- *Coburgia langensis* Herbert, loc. cit. 28: Misc. p. 53, 1842.- *C. obragillensis* Herbert, loc. cit. 28: Misc. p. 53, 1842.- *Stenomesson longifolium* Kraenzlin, Engler Bot. Jahrb. 40: 238, 1908.- *S. ferreyrae* Traub, Pl. Life 6: 95, 1950.- Pro syn.: *Coburgia laeta* Herbert, Edwards' Bot. Reg. 28: Misc. p. 53, 1842 (nomen subnudum).

Stenomesson recurvatum, of subgenus *Carpodetes* (Herb.) Tr., is remarkable by its one-valved spathe. The species inhabit mainly certain valleys in the Andes of the Lima department, Peru. In the Rimac Valley it reaches an altitude of 3500 m over the Sea.

Coburgia leata Herb. is a nomen subnudum, which may be referred to *S. recurvatum.*

Coburgia discolor Herb., discovered by Feuillée in South Peru, agrees with *S. recurvatum.* There is some material, in the Museum of Lima, collected in the department of Arequipa, which is identifiable with the figure of Feuillée (1725). The latter author collected the species in some of the coastal hills in the Moquegua Department. The notable distance that separates the populations of the Andes of Lima, from the southern plants, cannot be explained so far satisfactorily.

There is the slim possibility that *S. coccineum* and *S. recurvatum* are a single species. If this is proved from living material, the latter binomial should be chosen in orden to avoid any additional confusion. On the other hand, the origin, and identity, of *S. luteum* (Ruiz et Pav.) Bak. is still rather obscure.

Stenomesson incarum Kraenzl., originally collected in the "lomas" of the department of Arequipa, seems to be this same species.

I found fruiting plants on the top of the Rimac valley, above San Mateo, and at Llacshishi, on the mountains above Surco, both locations in the department of Lima.

Specimens: Peru, dept. Lima, Pacatulpe; leg. C. A. Redoutt, XII-1944 (USM) 14647. Idem, prov. Lima, abajo de Canta, 2400-2500 m; leg. R. Ferreyra 8914 & 8920, 15-I-1953 (USM, Herb. Rav.). Idem, Canta; leg. C. Acleto 58, 21-II-1960, v. n. "cichi-hica" (USM, Herb. Rav.). Idem, Monte Zárata, arriba de San Bartolomé, 2800 m; leg. R. Ferreyra s/n, 19-III-1960 (USM). Idem, prov. Huarochirí, San Pedro de Huancaire, 3100 m; leg. E. Solar Bustamante, 15-I-1953 (USM, Herb. Rav.), v. n. "china-huaita". Idem, Río Blanco, 3400-3500 m; leg. R. Ferreyra 14858, 21-I-1963 (USM). Idem, cerca de Río Blanco, ladera pedregosa, 3400-3500 m; leg. R. Ferreyra, I (USM). Idem, Infiernillo, entre San Mateo y Casapalca, 3300-3400 m; leg. R. Ferreyra s/n, 17-I-1949 (isotype of *S. Ferreyrae* Traub? USM). Idem, prov.

Yauyos, cerca de Tupe, 2800 m; leg. E. Cerrate 1281 (USM). Idem, Dept. Arequipa, near lomas de Chaparra between Chala and Atico, 200-300 m; leg. R. Ferreyra 1474, 19-X-1946 (USM). Idem, lomas cerca de Chala, camino a Chaparra, 500-600 m; leg. R. Ferreyra 11442, 10-X-1955 (USM). Cultivated; leg. R. Ferreyra s/n, 27-V-1948 (USM).

6. **STENOMESSON STRICKLANDII** BAK., AN ADDITIONAL SYNONYM FOR **S. AURANTIACUM**

Three different binomials *S. eustephioides* Herb., *S. hatwegio* Lindl. and *S. suspensum* Bak., were already listed under synonymy of *S. aurantiacum* (H.B.K.) Herb. (see Ravenna 1971, p. 83). To these I have to add now *stricklandii* Bak. The latter was imported by Sir C. W. Strickland of Yorkshire, from Quito, Ecuador. A photograph of the type-sheet, kindly sent from Kew Gardens, shows two scapes in flower, and another with a mature capsule already without seeds. Another photograph shows additional material of two scapes in flower, sent a year later to Baker by the same gentleman. The specimens can readily by identified as *S. aurantiacum*, which is the only species of the genus, apart from *S. incarnatum*, that is found near Quito. On the other hand, Baker's original description of *S. stricklandii*, and the generic one of *Stricklandia*, match completely with *S. aurantiacum*.

Baker (1888), transfers *Leperiza eucrosioides* Bak. to his new genus *Stricklandia*, listing *Stenomesson stricklandii* as a synonym. A phototype of *L. eucrosioides* shows what seemingly is a young inflorescence of a *Phaedranassa*, or possibly of an *Eucrosia*. The curved, although relatively short filaments, seem to support the latter appraisal. Bentham & Hooker f. (1883), transferred *L. eucrosioides* to *Phaedranassa* (see also Ravenna 1969 p. 61).

Specimens: Cultivated by Sir C. W. Strickland of Yorkshire, England, VI-1882 (phototype from K). Ex horto Sir C. W. Strickland, VI-1883 (photograph from K).

7. A NEW SPECIES FROM NORTH PERU

Stenomesson microstephium Rav., sp. nov.
(subgeneris Fulgituba) (Fig. 16.)

Species a *Stenomesso splendenti* proxima sed foliis canaliculato-convolutis pedicellis bene evolutis floribus minoribus staminibus et pocula staminali breviores differt.

Planta usque 12-30 cm alta. Folia serotina linearia vel lineari-angustata crassiuscula cinereo-viridia pruinosa ad 15-35 cm longa circ. 6-11 mm lata. Spatha bivalvata 35-45 mm longa; valvae deciduae ad basin liberae. Inflorescentia 7-10 flora. Pedicelli 18-35 mm longi. Flores aurantiaci vel coccinei declinati vel penduli rarissime horizontales 40-45 mm longi circ. 9-11 mm lati. Perigonii tubus et pars concrescens tepalorum circ. 20-30 mm longum. Tepala lanceolata, exteriora marginibus involutis ad 17-19.5 mm longa circ. 4-4.5 mm lata ad dorsum distincte viridi-tincta raro concolora. Tepala interiora acuta interdum pallidiora ad 17 mm longa circ. 4.6 mm lata. Pocula staminalis perbrevis saepe

usque 2 mm longa circ. 3.5 mm lata dentibus sex triangularibus instructa. Filamenta filiformia albolutescentia vel sordide albo-rosea, sepalina 1.5-2.5 mm longa, petalina 4-5.3 mm longa. Antherae aellypticae 3-3.9 mm longae; pollen luteus. Stylus 43-44 mm longus ultra stamines rubescens inferne albicans. Stigma capitatus. Capsula triceeco-globosa ad 15-18 mm lata. Semina compressa aellyptica nigra.

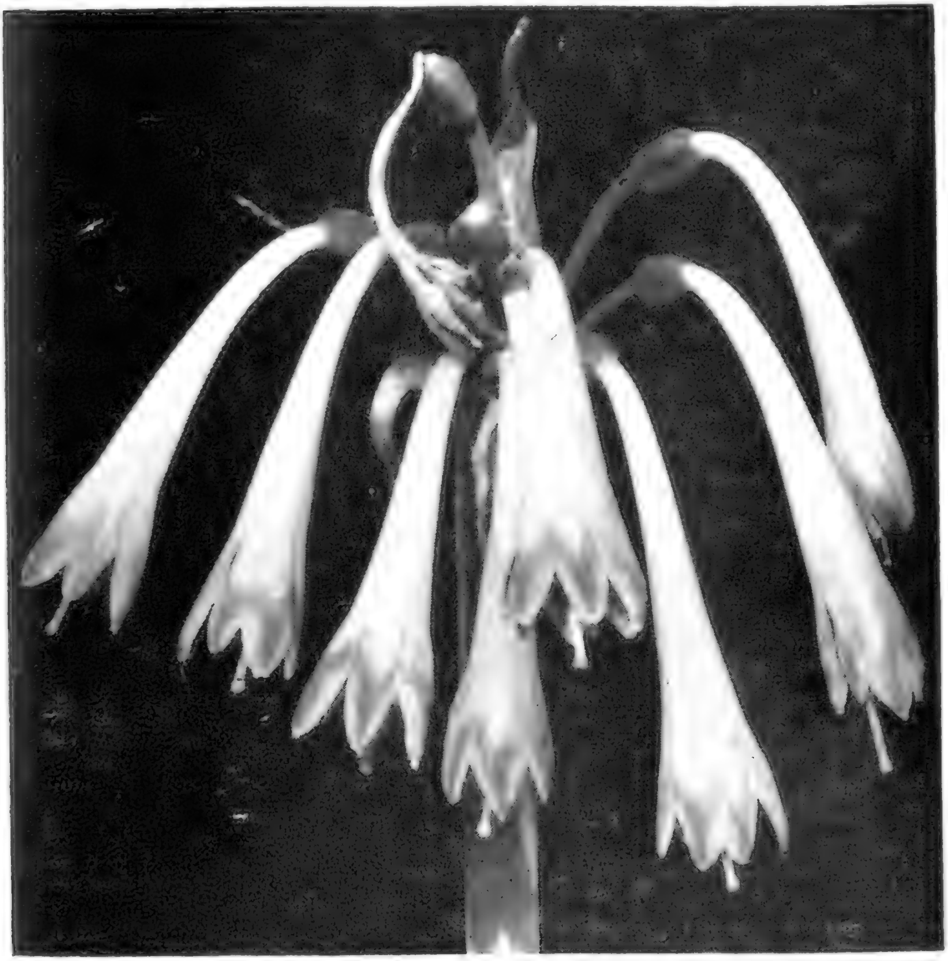

Fig. 16. **Stenomesson microstephium** Rav., inflorescence from a bulb collected at Jelic, Dept. of Cajamarca, Peru. Photo P. Ravenna

Plant up to 12-30 cm high. *Bulb* ovoid, 4-5 cm long, 30-45 cm wide, prolonged into a 4-9 cm long pseudo-neck; outer dry tunics breakable, a rather shiny dark brown. *Leaves* 2-3, serotinous, linear or linear-angustate, often markedly channeled, subcarinate, subacute, somewhat

fleshy, ash-green, 15-35 cm long, 6-11 mm broad. *Scape* compressed, 9-35 cm long, 5-7 mm broad. *Spathe* bivalved, marcescent, 35-45 mm long, its valves subequal, free to the base, often deciduous. *Umbel* 7-10-flowered. *Pedicels* 18-35 mm long. *Ovary* obovate, trigonous, green, tinged red at the apex, 5.5 mm long, 4.2 mm wide. *Perigone* declined or nodding, very rarely horizontal (?), 40-45 mm long, 9-11 mm wide, scarlet or orange tinged dirty green at the apex of tepals; *perigone-tube* and concrescent part of tepals not clearly distinguished. *Tepals* lanceolate; the outer with incurved edges, 17-19.5 mm long, 4-4.5 mm broad, with a diminutive tubercle at the apex, the greenish area being more distinct on the abaxial face. Inner tepals paler, with less incurved edges, up to 17 mm long, 4.6 mm broad, acute. *Staminal cup* very short, pale-red, 2 mm long, 3.5 mm in diameter; teeth six, deltoid, alternating the filaments. *Filaments* filiform, yellowish-white or a dirty pinkish-white; episepal 1.5-2.5 mm long, epipetal 4-5.3 mm long. Anthers elliptical, not distinctly versatile, 3-3.9 mm long; pollen yellow. *Style* 43-44 mm long, reddish above the stamens, whitish below. *Stigma* capitate. *Capsule* globose-tricoccous, 15-17 mm wide. *Seeds* compressed, elliptic, black. (Diagnostic figure in 1979 PLANT LIFE.)

Habitat.—Rocky slope called Jelic, in the department of Cajamarca, Peru; apparently also on the west side of the mountain belt of Calla-Calla; altitude: 2000-2700 m over the sea.

Specimens: In ditione Jelic civit. Cajamarcae Peruviae; leg. Ravenna 2096, cum Díaz Celis, 6-VII-1973 (typus in Herbario Ravennae). Idem ibid. Jelic (Celendín-Balsas), 3100 m; leg. Sagástegui, 5-V-1970 (TRP 7401). Idem ibid., 4 km east of Celendín, on road to Balsas; leg. P. C. Hutchison & J. K. Wright 5180, 19-V-1964 (USM). Idem, Cerros Calla-Calla, west slopes, gorge of Río Marañón, 23 km above Balsas, on the road to Leimebamba, Km 362; leg. P. C. Hutchison & W. Krahn 4972, 8-V-1964 (USM, TRB, UC).

Stenomesson microstephium appears as related to *S. splendens* (Herb.) Rav. The main distinguishing features are found in the well developed pedicels, smaller flowers, and very short staminal-cup and stamens.

II. A NEW *RAUHIA* SPECIES FROM THE DEPARTMENT OF AMAZONAS, PERU

Rauhia staminosa Rav., sp. nov. Fig. 17.

A *Rauhia multiflora* foliis aellyptico-acutis petiolo obscuro vel breviori filaments ex perigonio longe productis differt.

Plant up to 1 m high. *Bulb* globose, 8-10 cm wide, the outer-coats cartilagineous, a pale brown; pseudoneck short. *Leaves* elliptic or elliptic-oblong, subacute, broadly channelled, succulent, rather fragile, about two at anthesis, 15-30 cm long, 9-15 cm broad; the peticle short, often subterraneous. *Scape* cylindric, pruinose, up to 40-80 cm long, 7.5-12 mm thick above, embraced at the base by two, often not completely developed leaves. *Spathe* bivalved, marcescent; valves lanceo-

late, 32-40 cm long. *Umbel* 8-24-flowered. *Pedicels* cylindric, ascending or obliquely spreading, pruinose, ash-green, about 40-90 mm long. *Flowers* declined. *Ovary* ellipsoid, obtusely trigonous, ash-green, up to 9-11 mm long, 5-6 mm broad. *Perigone* ash-green, 50-60 mm long, 23-31 mm in diameter above. *Perigone-tube* infundibulate, about 14-17 mm long, the tepals then connate for 19-25 mm. *Tepals* lanceolate or oblanceolate, their margins maitish in the lower half, greenish-yellow, or even whitish upwards, a white streak within; the outer 20-23 mm long, 7 mm broad, minutely apiculate-tubercled; the inner narrowly obovate, their margins slightly weavy, up to 18-21.5 mm long, 9.5-10.5 mm broad. *Filaments* whitish or greenish-white, the upper episepal 46-50 mm long, lateral episepal pair 54-63 mm long, lower epipetal 61-64 mm long, lateral epipetal pair 62-65 mm long. *Anthers* elliptic-oblong, yellow, up to 2.8-3.4 mm long. *Style* 64-80 mm long, green. *Stigma* capitate, 1.2-1.9 mm broad. *Capsule* broadly pyramidate-tricoccous, trilobate below, ash-green, pruinose, 30-40 mm in diameter. *Seeds* flat, black, elliptical.

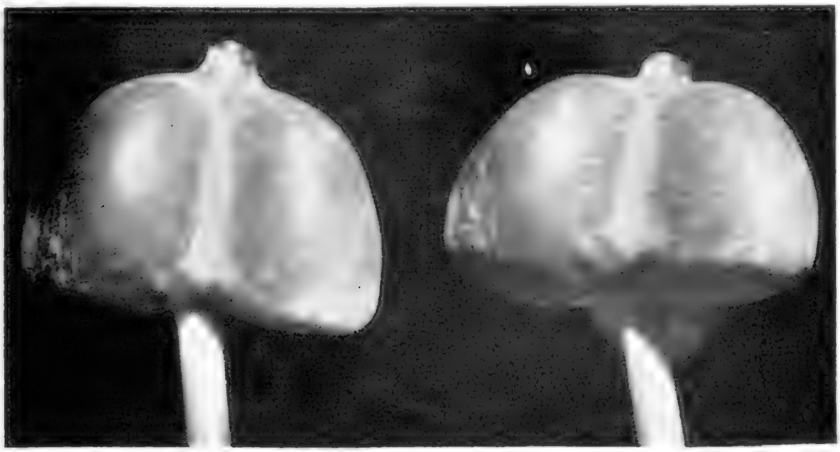

Fig. 17. **Rauhia staminosa** Rav., two different views of capsule. Photo P. Ravenna

Habitat.—Slopes above the Uteubamba river, especially between Bagua and Tingo, on the way to Chachapoyas, dept. of Amazonas, Peru. It sometimes grows among round stones, near the river banks, or among bushes in dry open woods. The region is a very warm one, with copious rains during June, July, and August, and possibly also in the rest of the year. The plants flower during the three months mentioned.

Specimens: Circ. 8 km ad meridionem Bagua ad viam Chachapoyas civit. Amazonas Peruviae; leg. Ravenna 2091, 3-VI-1973 (typus in Herb. Ravennae).

This is the second species of a remarkable genus. *Rauhia multiflora* (Kth.) Rav., the type-species, inhabits the warm valley of another tributary of the Marañón river, in the department of Cajamarca. The exceedingly long stamens is the most striking character that distinguish the new species. (Figure, flowering plant, in 1979 PLANT LIFE.)

III. A NEW *URCEOLINA* SPECIES FROM NORTH PERU

URCEOLINA CORYNANDRA RAV., SP. NOV. (SUBGENERIS **EUCHARIS**)
(FIGS. 18 AND 19)

Species a *U. narcissiflora* proxima sed pocula staminali dimidio breviore filamentis obtuse clavatis antheris minoribus differt; caeteris speciebus ex caracteres longe absunt.

Fig. 18. **Urceolina corynandra** Rav., upper view of flower, as photographed in the type locality. Photo P. Ravenna

Inflorescentia 4-12-flora. Flores distincte pedicellati; perigonii tubus ringens ad 16-27.5 mm longus; perigonium circ. 37-59 mm latum. Pocula staminalis lutescens vel luteo viridescens ad 3.5-4 mm longa dentis singulis inter filamenta instructa. Filamenta crassa perfecte clavata longiora usque 8 mm longa. Antherae versatiles nigricantes dense pubescentes ad 2.9 mm longae. Stigma capitatus.

Plant up to 35-56 cm high. *Bulb* globose covered with brown coats, 35-40 mm in diameter. *Leaves* long petioled, of a dark, shiny green, paler beneath, up to 40-59 cm long; petiole almost cylindric or slightly compressed, 15-39 cm long; blade lanceolate or ovate-lanceolate, acute, up to 13-29 cm long, 5-10 cm broad. *Scape* cylindrical, up to 2768 cm long, 1.9-4.4 mm thick at the apex, 4.7-8 mm at the base. *Spathe* bivalved, marcescent; valves lanceolate, up to 20-40 mm long. *Umbel* 4-12 flowered. *Pedicels* cylindrical-filiform, spreading obliquely, 11-43 mm long. *Ovary* in the same line as the pedicel, ovoid, a pale green, yellowish-green at the apex, up to 4.5-7 mm long, 2.9-4.1 mm broad. *Perigone-tube* nodding or curved, white, up to 16-27.5 mm long, 1.7-2.2 mm broad. *Perigone* white, 37-59 mm in diameter. *Tepals* lanceolate, spreading horizontally, or moderately reflexed from their base; the outer 19-33 mm long, 8.4-11.3 mm broad, very minutely apiculate; apicule 0.2-0.25 mm long; the inner ovate-lanceolate, subacute, 18.4-33 mm long, 11.5-15.5 mm broad. *Staminal cup* infundibulate, rather thick in texture, yellowish or greenish-yellow, with six obtuse teeth alternating with the filaments, up to 3.5-4 mm long, 6-6.8 mm in diameter. *Filaments* club-shaped, white, slightly shining; episepal 6-7 mm long, epipetal 6.4-8 mm long. *Anthers* versatile, linear-oblong, densely pubescent, blackish, about 2.9 mm long. *Style* filiform, white, up to 30-44.5 mm long. *Stigma* capitate.

Fig. 19. **Urceolina corynandra** Rav., flower with tepals removed, showing androecium and gynoecium. Photo P. Ravenna

Habitat.—Tropical forest, on slopes, near a small ravine with *Diefenbachia* sp., *Helyconia* sp., *Clusia* sp., and *Xyphidium coeruleum* Aubl., at Chinganza, in the department of Cajamarca, Peru.

Specimens: Chinganza inter Aramango et Montenegro civit. Cajamarca Peruviae; leg. Ravenna 2090, 2-VII-1973 (typus in Herb. Rav., isotypi K, NY, TRA).

This pretty species is closely related with *Urceolina narcissiflora* Huber. Its distinctive characters are found in the staminal cup, which is shorter by half, the club-shaped, not at all subulate filaments, and the smaller, markedly versatile, pubescent anthers. Both species are, in other respects, rather similar.

The natural enviroment of the species is found in a new colonization area. No doubt that the destruction of the forest will seriously affect its permanence in the future.

IV. NEW SPECIES IN THE GENUS *GRIFFINIA*

GRIFFINIA ROSTRATA RAV., SP. NOV.

Species peculiaris a caeteris speciebus perigonii tubo duriusculo supra fructum persistenti distincta.

Folia petiolata crassiuscula usque 43-48 cm longa; elamina acuta circ. 45-60 mm lata. Inflorescentia pauciflora. Pedicelli fructiferi erecto-patentes. Fructus obovato-aellypticus e perigonii tubum persistentem circ. 10-12 mm longum rostratus ad 33-42 mm longus circ. 25-28 mm latus. Semina dua vel tria per loculum subpyriformia ad 11 mm longa circ. 8-9 mm lata ab arilo carnoso notata.

Plant up to 35-40 cm high. *Bulb* thick (acc. to the collectors), whitish, prolonged into a pseudoneck. *Leaves* petioled firm-textured, up to 43-48 cm long; petiole 10-20 cm long; the blade obovate-oblanceolate, acute, 45-60 mm broad. *Scape* 27-28 cm long. *Umbel* 3-flowered. *Pedicels* of fruits erect, about 15-27 mm long. *Capsule* green, obovate-elliptic, rostrate due to the persistent perigone tube on its apex; beak 10-12 mm long. *Seeds* 2-3 in each cell, subpyriform, fleshy, reddish in the herbarium, bearing a thick unilateral aril, up to 11 mm long, 8-9 mm wide.

Specimens: Brazil, Mato Grosso, Vale dos Sonhos, ca. 93 km from Xavantina, on Aragarças road, evergreen forest; leg. Harley et al. 10975, 9-XI-1968 (type UB, isotype K).

The amazing features of fruit, and seeds, suggest that also the flowers could bear some peculiar feature. It is therefore unfortunate that only fruiting plants were found by the collectors.

GRIFFINIA ARACENSIS RAV., SP. NOV. SEE PLANT LIFE 30: 69, 1974

A *Griffinia parviflora* qui specie Bahiensi foliis angustioribus cinereo-maculatis differt. *G. liboniana et rochae* ad speciem nostram valde similes sed staminibus quinque habent.

Planta ad 15 cm vel infra alta. Folia oblanceolato-petiolata usque 7-18 cm longae; petioli circ. 5-9 cm longi; lamina fusco-viridia cinerreo-maculata ad 7.5-25 mm lata. Pedicelli 10-17 mm longi. Flores usque 13-25 mm longi circ. 22-30 mm lati. Tepala anguste oblanceolata ad 19-22 mm longa praeter interiori-inferius qui angustius caetera circ. 2.5-2.8 mm lata.

Plant up to 15 cm high, or less. *Leaves* six, oblanceolate petiolate, 7-18 cm long; petioles 5-9 cm long; blades a dark green, variously spotted

with grayish-white or grayish-green, acute, 7.5-25 mm broad. Scape 7.2-12 cm long. *Spathe* bivalved, membranous, hyaline; valves often unequal, broadly lanceolate, ventricose, 11-23 mm long, connate toward the base for 3-5 mm, abruptly narrowed upwards. *Umbel* 4-7-flowered. *Pedicels* 10-17 mm long. *Perigone* horizontal, 13-25 mm long, 22-30 mm in diameter. *Tepals* narrowly oblanceolate, whitish in the lower half, lilac above, 19-22 mm long, excepting the lower inner, which is narrower, the rest 2.5-2.8 mm broad, the outer series distinctly apiculate; apicule ca. 0.8 mm long, puberulent on the inner half. *Filaments* thin, filiform, ranging from 10 to 15 mm in length, declinate, flexuose, not closely fasciculate, the upper episepal ascending. *Anthers* almost falcate 2.5 mm long. *Style* declinate, prominent, up to 22 mm long. *Stigma* minutely capitate.

Specimens: Brazil, Minas Gerais, Serra dos Aracás near (Matozinhos); leg. E.P. Heringer 72-40, 26-X-1959 (typus UB).

The species was already proposed by me in volume 30, p. 69 of this journal. Unfortunately, due to the ommision in print of the last part of the text (including the specimen paragraph), the species was invalidated.

In its small habit, the species approaches to *G. itambensis* Ravenna (1974, p. 68), differing in the narrower, grayish-spotted leaves, and smaller flowers. *G. rochae* Morel (see fig. 20 in vol. 30 of Plant Life) is also a small species; it is separable from our plant on account of the shortly petioled, non-spotted leaves, and the lack of the upper episepal stamen.

V. STUDIES IN *ZEPHYRANTHES*

Haylockia cochabambensis is tranferred to *Zephyranthes*. *Z. stellaris* is reported for the first time in Brazil

1. **ZEPHYRANTHES COCHABAMBENSIS** (CARD.) RAV., COMB. NOV.

Haylockia cochabambensis Cárdenas, Pl. Life 29: 44, 1973.—Pro syn. *Zephyranthes challensis* Ravenna, Pl. Life 30: 39, 1974.

Zephyranthes challensis apparently is a synonym of the present species. Due to an unfortunate circumstance, volume 29 of Plant Life was lost in transit to me. The description of Cárdena's *Haylockia cochabambensis* was unknown to me until volume 30 of this journal, where *Z. challensis* appeared, already issued.

It was already stated (see Ravenna, 1971) that *Haylockia* must be regarded as a synonym of *Zephyranthes*. *Z. cochabambensis* furnishes additional evidence on this respect. In fact, this species sometimes developes a short, although distinct scape above the ground (see Pl. Life 30, fig. 11), approaching to subgenus *Zephyranthes*.

2. **ZEPHYRANTHES STELLARIS**, REPORTED IN THE BRAZILIAN FLORA

Among some material collected by G. Hatschbach in Mato Grosso, Brazil, a *Zephyranthes* species seemed rather familiar. A close examination revealed that it represented *Z. stellaris* Rav., hitherto reported for

Argentina, and Paraguay (see Ravenna, 1967). Another rather old Brazilian specimen, is found in the Instituto Darwinion of San Isidro, Argentina. This was collected between Alegrete and Capivarí, Río Grande do Sul, and bear the annotation "flores amarillas" (yellow flowers), which probably is a mistake.

The range of the species is therefore extended to the east, in Río Grande do Sul, and to the north, at 19° 10' S, in Mato Grosso, Brazil.

Specimens: Brazil, Mato Grosso, Serra de Urucum, "lajeados da base dos morros"; leg. Hatschbach & Cheres 30447, 13-IV-1972 (Herb. Rav., Herb. Hatschbach). Río Grande do Sul, Alegrete a Capivarí; leg. E. Nicora SI).

Additional specimens for Argentina and Paraguay: Argentina, prov. Santa Fe, dept. Gral. Obligado, Lauteri; leg. Maldonado-Bruzzone 1665, 8-XII-1945 (LP). Prov. Chaco, Colonia Resistencia; leg. ? (LPS at LP). Paraguay, orilla izquierda del río Tabicuary, cerca de Villa Florida; leg. Balansa (?) 19510 (LPS at LP). Idem, Hiasi; leg. Joergensen 3877, March (SI).

VI. STUDIES IN THE GENUS *PYROLIRION*

1. **PYROLIRION CUTLERI** (CARD.) RAV., COMB. NOV.

Zephyranthes cutleri Cárdenas, Pl. Life 29: 38, fig. 11, a & b, 1973.

The perigone shape, and the existence of three, spoon-like stigmas, along with the characters of capsule, and seeds (see below), are reasons for transfering the species to *Pyrolirion*.

2. ADDITIONAL CHARACTERS FOR DISTINGUISHING **PYROLIRION** FROM **ZEPHYRANTHES**

The morphology of capsule and seeds, for the purpose of distinguishing *Pyrolirion* from *Zephyranthes*, has so far been overlooked.

Cárdenas (1971, p. 40, figs. 13 & 14) describes, and illustrates for the first time, the capsule and seeds of *P. boliviense* (as *P. xyphopetalum*). Later (se Cárdenas 1973), he describes, and illustrates, those of *P. cutleri* (as *Zephyranthes cutleri*), giving strength to the position assumed here, that their shape is a constant feature in the genus.

KEY TO **ZEPHYRANTHES** AND **PYROLIRION**

1a. Stigmatose area covering the whole upper part of a true trifid stigma. Capsule depressedly globosetricoccous, wider than long, deeply trivalved at maturity. **Seeds not winged** .... **ZEPHYRANTHES**

1b. Stigmatose area at the apex of three, conduplicate, flattened styly arms. Capsule elliptical-oblong, longer than wide, not distinctly tricoccous, opening in the upper third or half. **Seeds with a whitish unilateral wing.** .... **PYROLIRION**

P. tubiflorum never produces fruits under culture, and apparently nor even in wild state; hence the reason that they were not described. The species propagates by means of bulblets, that the plants produce in great number similarly as in *Nothoscordum inodorum* of the Alliaceae.

VII. STUDIES IN THE GENUS *HABRANTHUS*

1. FOUR NEW SPECIES AND A NEW COMBINATION

HABRANTHUS MAASII RAV., SP. NOV.

Planta usque 17-30 cm alta. Folia ad anthesin incipientia linearia ad 9-10 cm longa circ. 2 mm lata. Scapus 9.5-19 cm longus. Spatha uniflora usque 21-39 mm longa superne bifida. Pedicellus circ. 27-56 mm. longus. Flos cernuus roseus ad 46-68 mm longus circ. 24-32 mm latus. Tepala oblanceolata ad 4-5 mm inferne connata ad 4-6 cm longa. Filamenta declinato adscendentia, sepalinum superius 5-8 mm longum sepalina lateralia 9-17 mm longa petalinum inferius 5-8 mm longum petalina lateralia 18-28 mm longa. Antherae falcatae circ. 3-7 mm longae. Stylus declinatus ad 30-35 mm longus. Stigma trifidus lobis arcte recurvatis ad 4-6 mm longis.

Plant up to 17-30 cm high. *Bulb* unknown, but from the remnants in the specimen, prolonged into a pseudo-neck. *Incipient* leaves linear, 9-10 cm long, 2 cm broad. *Scape* seemingly robust, 9.5-19 cm long. *Umbel* one-flowered, membranous tubular for 15-25 mm, then two-parted, 6-14 mm long lobes. *Pedicel* 27-56 mm long. *Flower* cernuous. *Ovary* elliptic-oblong, up to 4-6 mm long, 2-2.5 mm wide. *Perigone* pink, 46-68 mm long, 24-32 mm in diameter. *Tepals* oblanceolate, joined below for 4-5 mm, then 4-6 cm long, the outer 10-14 mm broad, the inner slightly narrower. *Filaments* declinate-ascending, the upper episepal 5-8 mm long, lateral episepal 9-17 mm long, lower epipetal 15-25 mm long, lateral epipetal 18-28 mm long. *Anthers* falcaie, 3-7 mm long. *Style* declined 30-35 mm long. *Stigma* trifid, the divisions 4-6 mm long, strongly recurved.

Specimens: Argentina, province of Jujuy, San Lorenzo, río de San Lorenzo; leg. Lorentz et Hieronymus, Ende X-1873 (Herbarium of Otto Kuntze, presented by Mr. Andrew Carnegie, 1908, determined as *Zephyranthes mesochloa* f. *rosea* O.K., typus NY).

The type-specimen of this species is determined as "*Zephyranthes mesochloa* forma *rosea* O.K.". I do not know whether such a name is published or not. If so, the mentioned specimen probably is the type. In any case, there are no impediments to use the same specimen as the type of a new species.

The epithet *roseus* cannot be used in *Habranthus*, due to the previous existence of *H. roseus* Sw. It is therefore a pleasure to name this species in honor of the distinguished botanist and friend, Dr. P.W.J. Maas, of Utrecht, Holland.

HABRANTHUS STEYERMARKII RAV., SP. NOV.

Species a *Habrantho spectabili* proxima sed floribus haud lilacinis sed albis et minoribus; a *H. niveo* floribus multo minoribus foliis haud glaucis, a *H. salinari* et *andalgalensi* folia tepalaque valde latiora recedit.

Planta ad 14-20 cm alta. Folia ad anthesin nulla. Scapus usque 9-12 mm longus. Spatha uniflora. Pedicellus spathae exsertus. Flos

albus ad 42-50 mm longus (in sicco). Tepala usque 2.5 mm connata, exteriora ad 40-50 mm longa circ. 8-9 mm lata, interiora ut videtur subaequalia. Filamenta fasciculato-declinata ad apicem valde incurvata. sepalinum superius 5-7 mm longum sepalina lateralia 7.5-8 mm longa petalina lateralia 17-20 mm longa petalinum inferius 20-22 mm longum. Stylus usque 22-26 mm longus. Stigma trifidus lobis 4.5 mm longis oblique patentibus ad apicem recurvatis.

Plant up to 14-20 cm high. *Bulb* ovoid, up to 30-45 mm long, 21-31 mm wide, prolonged into a 45-70 mm long pseudo-neck; outer coats brown, corrugate. *Leaves* none at anthesis. Scape 9-12 cm long. *Spathe* membranous, tubular for 19-24 mm, then bifid for 12-13 mm. *Umbel* one-flowered. *Pedicel* to 22-42 mm long. Ovary elliptical-oblong, up to 5-6 mm long, 1.3-1.4 mm wide (when dry). *Tepals* oblanceolate joined at the base for 2.5 mm; the outer 40-50 mm long, 8-9 mm broad, the inner seemingly as long as the outer. *Filaments* fascicled-declined rather incurved above; upper episepal 5-7 mm long, lateral episepal 7.5-8 mm long, lateral epipetal 17-20 mm long, lower epipetal 20-22 mm long. *Anthers* markedly falcate after pollen shedding, up to 4.5-5 mm long. *Style* declined, up to 22-26 mm long. *Stigma* trifid, its divisions at first obliquely spreading, then recurved, to 4.5 mm long.

Habitat.—The natural enviroment of this species is the dry wood of the Chaco formation, in the north-eastern part of the province of Jujuy, Argentina. Several years ago I gathered bulbs between Fraile Pintado and Ledesma, in the same region. The plants were growing near *Amaryllis parodii,* in a rather sandy soil.

The species is properly dedicated to Dr. Julian Steyermarkii, of the Instituto Botánico Caracas, Venezuela, for his outstanding contributions to the Botany of this Continent.

Specimens: Argentina, dept. San Pedro, San Pedro; leg. Cabrera & Kiesling 20277, 10-XII-1969 (LP). Idem, dept. Santa Bárbara, El Fuerte, 1380 m; leg. Cabrera 16287, 24-X-1964 (LP). Idem, Est. Calilegua, San Lorenzo; leg. Joergensen-Hansen, XI-1911 (typus SI 3570, isotypus BAB 35870).

This interesting species has its closest relative in *H. spectabilis Ravenna* (1969). However, it is distinguished by the almost pure white, smaller flowers.

HABRANTHUS NULLIPES RAV., SP. NOV.

Planta supra solum circ. 5-6 cm alta. Bulbus ovatus ad 35-37 mm longus circ. 24 mm latus in collo circ. 35 mm longo productus; tunicae exteriores ochraceae. Scapus perbrevis usque 20 mm longus leviter compressus ochraceus ad 2.9 mm latus. Spatha circ. 24 mm longa pallide ochraceo-viridescens inferne usque 4-5 mm tubulosa ad apicem circ. 8 mm bifida. Inflorescentia uniflora. Pedicellus nullus. Ovarium obovatum ochraceo-viridescente ad 4.9 mm longum circ. 3 mm latum. Perigonium sub sole bene expansum late infundibulatum circ. 50 mm latum. Tepala oblanceolata inferne usque 7 mm inter se connata, exteriora 35 mm longa circ. 8.9 mm lata albicantia striis roseo-ochraceis notata

extus basin versus viridescentia ad apicem tuberculato-apiculata; apiculus extus viridis; tepala intediora ad 34 mm longa circ. 10-10.5 mm lata obtusiuscula vel subacuta. Filamenta fasciculato-declinata alba, sepalinum superiorius 14 mm longum, petalina lateralia 15 et 19 mm longa, sepalina lateralia 14 et 16 mm longa, petalinum inferius 17-18 mm longum. Antherae semilunato-reniformes luteae ad 2.6-2.9 mm longae. Stylus declinatus albus ad 28-29 mm longus. Stigma trifidus albus lobis recurvato-patentibus vel erecto-patentibus 1.8-2 mm longis.

Plant up to 5-6 cm high. Bulb ovoid 35-37 mm long, 24 mm wide, prolonged for 35 mm into a pseudo-neck; the outer coats brownish. ***Scape*** very short, up to 20 mm, slightly compressed, brownish, 2.9 mm broad. ***Spathe*** up to 24 mm long, a pale greenish-brown, tubular below for 4.5 mm, bifid for 8 mm. Inflorescence one-flowered. ***Pedicel*** absent. ***Ovary*** obovoid greenish-brown, 4.9 mm long, 3 mm wide. ***Perigone*** expanding well only in the sun, widely funnel-shaped, 50 mm in diameter. ***Tepals*** oblanceolate, joined for 7 mm below; the outer 35 mm long, 8.9 mm broad, whitish with purplish-brownish streaks, greenish on the outer face below; a distinct apicule, dorsally green, with a distinct tubercle below. Inner tepals 34 mm long, 10-10.5 mm broad, rather obtuse or subacute. ***Filaments*** fascicled, declined, white; the upper episepal 14 mm long, lateral episepal 14-16 mm long, lateral epipetal each respectively 15 and 19 mm long, lower epipetal 17-18 mm long. ***Anthers*** lunulate-reniform, yellow, 2.6-2.9 mm long. ***Style*** declined, white, 28-29 mm long. ***Stigma*** trifid, white, its branches spreading recurvely or upright, 1.8-2 mm long.

Habitat.—Bolivian plateau, near Uyuni, dept. of Potosí, Bolivia. The species is found in the steppe, at nearly 3500 m, growing near *Cardenanthus* aff. *orurensis* Fost. (Irid.), *Stenommesson* sp.(?), *Descurainia* sp. (Cruciferae), *Chuquiraga* sp., and other rosulata Compositae.

Specimens: Culta in Santiago ex bulbo in stepposis pr. Uyuni Boliviae collecto; leg. Ravenna 2211, 23-XII-1976 (typus in Herb. Ravennae). (Diagnostic figure in 1979 PLANT LIFE.)

This unusual *Habranthus* is distinguished by having a very short, almost obsolete scape, with a single sessile flower. The latter feature is unique in the genus. The species reminscent somewhat of *H. erectus*, which has a short pedicel.

HABRANTHUS LEPTANDRUS RAV., SP. NOV.

Species a *Harbrantho saltensi* proxima sed perigonio praecipue carmineo antheris omnibus linearibus recedit.

Planta ad anthesin absque foliis usque 7 cm alta. Spatha membranacea sordide albo-rosea usque 10 mm tubulosa deinde circ. 11-11.5 mm bifida. Inflorescentia uniflofora. Pedicellus 17.5-19 mm longus. Flos leviter inclinatus. Ovarium clavatum vel oblongum ad 4.5 mm longum circ. 1.9 mm latum. Perigonium usque 25 mm longum circ. 30 mm latum. Tepala oblanceolata inferne circ. 2-2.3 mm connata usque 18 mm imbricato-contigua tubum simulantia deinde sub sole patentia ad basin veram lutescentia ad partem contiguam pallide roseo-

virideseentia sursum intense carminea intus in medio inferiori albicantia, exteriora ad 30-31 mm longa circ. 7 mm lata tuberculato-apiculata; (apiculus circ. 1.2 mm longus), interiora ad 32.5-33 mm longa circ. 3.7-3.8 mm lata subacuta. Filamenta stricte fasciculata tenuiter filiformia alba, sepalinum superius 5.5 mm longum, sepalina lateralia 7 mm longa, petalina lateralia 12.5 mm longa, petalinum inferius 14 mm longum. Antherae lineares interdum leviter tortiles luteae in perigonio haud versatiles ad 5.8-6.7 mm longae. Stylus rectus haud declinatus albus ad 18 mm longus. Stigma trifidus lobis albis recurve patentibus ad 3-3.5 mm longis.

Plant up to 7 cm high. Bulb ovoid, 33 mm long, 25 mm wide, prolonged for 20-25 mm into a pseudo-neck, the coats blackish. *Leaves* none at anthesis, serotine; after anthesis linear, grey-green, slightly pruinose, spreading upwards, up to 8-15 cm long, 3-4 mm broad. *Scape* weak, subcylindrical, brownish-green, up to 13 mm long, 1.7 mm broad. *Spathe* membranous, dirtily whitish-pink, tubulfor 10 mm below, then bifid for 11 mm above. *Umbel* one-flowered. *Pedicel* dertily greenish, up to 17.5-19 mm long. *Flower* slightly inclined. *Ovary* club-shaped or almost cylindrical, 4.5 mm long, 1.9 mm wide. *Perigone* 25 mm long, when fully expanded, 30 mm in diameter. *Tepals* oblanceolate joined at the base for 2-2.5 mm, imbricatelly contiguous and simulating a tube for 18 mm, then spreading, yellowish at the very base, palely greenish-pink on the contiguous portion, intensely carmine upwards, whitish in the lower half inside; the outer 30-31 mm long, 7 mm broad apiculate-tubercled (the apicule 1.2 mm long); the inner 32.5-33 mm long, 3.7-3.8 mm broad, subacute. *Filaments* filiform, weak, white, closely fascicled; the upper episepal 5.5 mm long, lateral episepal 7 mm long, lateral epipetal 12.5 mm long, lower epipetal 14 mm long. *Anthers* linear sometimes slightly twisted, up to 5.8-6.7 mm long, yellow, not versatile at least when surrounded by the tepals. *Style* straight, not declined, white, up to 18 mm long. *Stigma* trifid the divisions white spreading recurvely, 3-3.5 mm long.

Habitat.—Meadows at the Chaguarani gulch, in the prov. of Mizque, dept. Cochabamba, Bolivia. It grows in sandy soil near *Junellia* sp. (Verbenaceae), *Oxalis* sp., *Portulaca* sp., and several grasses.

Specimens: Culta in Santiago ex bulbis in herbosis amoenis ad Chaguarani prov. Mizque civit. Cochabamba, Boliviae collectis; leg. Ravenna 2212, XII-1976 (typus in Herb. Ravennae).

This interesting species approaches in some manner to *H. saltensis* (see Fig. 15 in vol. 30 of this Journal). In the latter, the anthers of the episepal stamens are almost linear, quite distinct from those of the epipetal series, which are semilunate. The reason for this dimorphism, as assumed before (Ravenna 1970 & 1971b), may be the circumstance of being concealed by the contiguius portion of tepals.

In *Habranthus leptandrus,* both series of stamens are hidden in the narrow tube formed by the lower half of tepals. Suggestively enough, all the stamens bear here linear, non-versatile anthers.

The expanded part of the flower is of a deep, homogeneous carmine

color, rather unusual in the South American representatives of the genus. The species may be a pretty object for horticulture.

HABRANTHUS MICROCARPUS (RUSBY) RAV., COMB. NOV.

Atomosco microcarpa Rusby, Nem. New York Bot. Gard. 7:213, 1927.

I recently detected the holotype of this entity in the general herbarium of the New York Botanical Garden. It represents an *Habranthus* species, not a *Zephyranthes* (syn. Atamosco Adans.).

Specimens: Bolivia, dept. Beni, pampas near lake Rogagua, 1000 m; leg. M. Cárdenas 1396, (1-XI-1921 type NY).

2. **HABRANTHUS CARMINEUS** RECORDED IN THE FLORA OF URUGUAY

Years ago (see Ravenna 1970, p. 5), I described *Habranthus carmineus* from living plants flowered at Buenos Aires from bulbs gathered by me near Concepción del Uruguay, Argentina. The flower is whitish or pinkish with carmine tones. The stigma divisions are the longest in the genus. The latter feature leads to easy identification of the species.

A specimen from Uruguay in the herbarium of the Instituto Darwinion, Argentina, belongs to this species. The geographical area is therefore extended to the east into the Uruguay Republic.

Specimens: Uruguay, dept. Colonia Suiza, Colonia Suiza, leg. I. De la Rua, 1-1910 (SI 34).

VIII. STUDIES IN THE GENUS *AMARYLLIS*

Two new species from Brazil, and a new form of *A. argentina* are described.

1. **AMARYLLIS CURITIBANA** RAV., SP. NOV.

Planta usque 44-48 cm alta. Folia basalia ad anthesin incipientia lineari-ensiformia marginibus tenuis. Spatha circ. 45-57 mm longa valvis subaequalibus lanceolatis. Inflorescentia biflora. Flores ascendentes praeter basin viridem rubri. Tepala oblanceolata inferne circ. 10-11 mm connata, exteriora ad 9 mm longa circ. 30-32 mm lata lateralia contigua, interiori-lateralia ad 73-78 mm longa circ. 14 mm lata, interiori-inferius acutum ad 70 mm longum circ. 10 mm latum. Filamenta arquate ascendentia ad apicem haud incurva quadriseriata circ. 57-70 mm longa. Antherae oblongo-reniformes. Stylus horizontalis ad 80-86 mm longus. Stigma trifidus.

Plant up to 44-48 cm high. *Bulb* widely ovoid or subglobose to 35-40 mm long, 32-38 mm wide prolonged into a 20-30 mm long pseudoneck. *Leaves* at anthesis not fully developed, up to 11-15 cm long, 11-13 mm broad, subacute. *Scape* single or two, about 93-34 cm long, 13-15 mm broad near the base. *Spathe-valves* lanceolate, free to the base, up to 45-57 mm long. *Umbel* 2-flowered. *Pedicels* up to 35-37 mm long. *Flowers* obliquely ascending, red, with a green base which dilutes upwards almost to the apex of the tepals. *Tepals* lanceolate concrescent below for 10-11 mm; the outer 9 cm long, 30-32 mm broad, the lateral

pair contiguous with slightly connivent apices, the apicule 1.7-2 mm long; inner tepals up to 73-78 mm long, 14 mm broad, except the lower which is 70 mm long, 10 mm broad, more acute, and subtended by the lateral, contiguous outer tepals. *Filaments* archedly ascending, not at all incurved at the apex; the lateral episepal 57-58 mm long, the upper episepal 60 mm long, lower epipetal 62-63 mm long, lateral epipetal 67-70 mm long. *Anthers* reniform-oblong, up to 3.9-4.5 mm long. *Style* lying on the lower inner-tepal up to 80-86 mm long. *Stigma* trifid, the divisions 3.5-4.5 mm long, recurved.

Specimens: Brazil, Paraná, mun. Curitiba, BR-116, Río Iguazú; leg. Kummrow 642-8 (Typus Herb. Rav., isotypus Herb. Hatschbach).

This is another species in the Series *Aviflorcae*, subgenus *Omphalissa.* Its closest relative appear to be *A. iguazuana* Rav., differing in the more uniform red color, less undulate tepals, and longer stigma divisions.

2. **AMARYLLIS LEUCOBASIS** RAV., SP. NOV. (SUBGENUS **OMPHALISSA**)

Planta saltem 40 cm alta. Folia basalia ad anthesin incipientia lineari-lorata textura firm circ. 11-14 mm lata marginibus callosis. Scapus circ. 28 cm langus usque 10 mm latus. Valvae spathis 40-45 mm longae. Inflorescentia biflora. Flores cernui. Perigonium infundibulatum ruber ad basin albus (fide coll.). Stamina arquato-adscendentia prominentia. Antherae 5-6 mm longae. Stylus declinato-arquatus ad 9-12.4 cm longus. Stigma subcapitatus obscure trilobatus.

Plant up to 40 cm high or perhaps more. *Bulb* globose 5-5.5 cm in diam., prolonged into a 30-35 mm long pseudo-neck. *Leaves* linear-lorate at anthesis not fully developed, firm textured, with distinct callose edges, about 75-95 mm long, 11-14 mm broad, subacute. *Scape* up to 28 mm long, 10 mm broad. *Spathe-valves* 40-45 mm long. Inflorescence 2-flowered. *Pedicels* 39-43 mm long. *Flowers* cernuous. *Ovary* obovoid or subellipsoid 8-9 mm long, 4-4.5 mm broad. *Perigone* infundibulate up to 8.5-11.5 cm long, 8-9 cm in diam. *Stamens* prominent; its filaments archedly ascending, not at all incurved at the apex, the upper episepal 6.5-9 cm long, lateral episepal 7-9.6 cm long, lower epipetal 7.5-10 cm long, lateral epipetal 7.7-10.6 cm long. *Anthers* 5-6 mm long (after dehiscence). *Style* archedly declined, up to 9-12.4 cm long. *Stigma* subcapitate, obscurely trilobed.

Specimens: Brazil, Goiás, mun. Mineros, BR-364, prox. Córrego Alegre; leg. Hatschbach 35016 & R. Kummrow. (typus in Herb. Ravennae, isotypus Herb. Hatschbach).

The leaves of this interesting species are narrow, with callose edges like those in *A. solandraeflora.* However, the flower is totally different. With arched, prominent, not at all incurved filaments, it clearly belongs in subgenus *Omphalissa.* According to the collector, the perigone is red with a white base, an unusual arrangement of colors! Hence the specific epithet.

3. **AMARYLIS ARGENTINA** (PAX) RAV. FORMA **ROSEA** (RAV., F. NOV.

A forma typica floribus roseis recedit. It differs from the typical form in its pink flowers.

Habitat.—An element of the Chaco-like vegetation in the north-eastern part of the province of Tucumán, in Argentina.

Specimens: Cerro del Campo in ditione Burruyacu provinciae Tucumán Argentinae; leg. Ravenna 115, XII-1961 (typus in Herb. Ravennae).

A single clump of this form was found by me several years ago in the above mentioned place. There is another specimen of the same, in the Argentine Museum of Natural History, collected by S. Venturi also in the department of Burruyacu.

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REGISTRATION OF NEW AMARYLLID CLONES

MR. JAMES M. WEINSTOCK, *Registrar*
10331 Independence, Chatsworth, Calif. 91311

This department has been included since 1934 to provide a place for the registration of names of cultivated **Amaryllis** and other amaryllids on an international basis. The procedure is in harmony with the International Code of Botanical Nomenclature (edition publ. 1961) and the International Code of Nomenclature for Cultivated Plants (edition publ. 1958). Catalogs

of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, **"Descriptive Catalog of Hemerocallis Clones, 1893-1948"** by Norton, Stuntz and Ballard was published in 1949. Additional catalogs of cultivars have been published since 1949: **Catalog of Brunsvigia Cultivars, 1837-1959,** by Hamilton P. Traub and L. S. Hannibal, PLANT LIFE 16: 36-62. 1960; Addendum. PLANT LIFE 17: 63-64. 1961; **Catalog of Hybrid Nerine Clones, 1882-1958,** by Emma D. Menninger, PLANT LIFE 16: 63-74. 1960; Addendum, PLANT LIFE 17: 61-62. 1961; **The Genus X Crinadonna,** by Hamilton P. Traub, PLANT LIFE 17: 65-74. 1961; **Catalog of Hybrid Amaryllis Cultivars, 1799-1963,** by Hamilton P. Traub, W. R. Ballard, La Forest Morton and E. Authement, PLANT LIFE. **Appendix** i-ii + 1-42. 1964. Other catalogs of cultivated amaryllids are scheduled for publication in future issues. These may be obtained at $8.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Jolla, Calif. 92038.

The registration activity of the American Plant Life Society was recognized when at the XVIth International Horticultural Congress, Brussels, 1962, the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for the cultivars of **Nerine;** and this was extended to include all the **Amaryllidaceae** cultivars, excepting **Narcissus** and **Hemerocallis,** at the XVIIth International Horticultural Congress, 1966.

Only registered named clones of **Amaryllis** and other amaryllids are eligible for awards and honors of the American Amaryllis Society at Official Amaryllis Shows.

Correspondence regarding registration of all amaryllids such as **Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis,** and so on, should be sent to Mr. Weinstock at the above address. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

REGISTRATION OF NEW AMARYLLIS CLONES, 1977

Registered by John Wade Deme, Rt. 5, Box 236, Kinston, N. C. 28501

Amaryllis clone **'Delbert Howard'** (Deme, 1977); **A-1016;** U-4-6 fld; 20" h; flower double, 6" across face, 16 petals. Petals have a wide dark salmon border on each petal, the center of each petal is white, hose on hose petal arrangement. Vigorous. Blooming dates not now established, but does bloom during winter months.

Amaryllis clone **'Double Salmon'** (Deme, 1977); **A-1017;** U-4 fld; 20" h; flower double, 6½" across face, 17 petals. Petals all salmon except for a small white streak in lower center of each petal. Hose on hose petal arrangement. Vigorous. Blooms any month of year and has produced 6 scapes in a one-year period.

Amaryllis clone **'Judy'** (Deme, 1977); **A-1018;** U-4 fld; 24" h; flower double, 6" across face, 18 petals. Petals dark orange-red with center of throat white. Hose on hose petal arrangement. Vigorous. Has produced 5 scapes in a one-year period.

Amaryllis clone **'Judy Weston'** (Deme, 1977); **A-1019;** U-4-6 fld; 20" h; flowers double, 6" across face, 21 petals. Petals are light pink with white veins. Lower center of each petal is white. Hose on hose petal arrangement. Vigorous winter bloomer, but specific dates not as yet established.

Amaryllis clone **'Kristy'** (Deme, 1977); **A-1020;** U-4-6 fld; 16" h; flower double, 6" across face, 16 petals. Petals a mixture of dark red and white, hose on hose petal arrangement. Vigorous, blooming any month of year and as many as four scapes per year.

Amaryllis clone **'Louis Parajos'** (Deme, 1977); **A-1021;** U-4-5 fld; 16" h; flower double, 6" across face, 19 petals. Petals have dark orange-red border and center part of each petal is white. Hose on hose petal ar-

rangement. Vigorous winter bloomer.

Amaryllis clone **'Lynn'** (Deme, 1977); **A-1022;** U-4-6 fld; 24" h; flower double, 6" across face, 16 petals. Petals orange-red, center of each petal white. Hose on hose petal arrangement. Vigorous, producing as many as six scapes during any months of a single year.

Amaryllis clone **'Matilda Farajos'** (Deme. 1977); **A-1023;** U-4-5 fld; 16" h; flower double, 6" across face, 15 petals. Petals are picotee with pink and some pink flushes on the upper petals; hose on hose petal arrangement. Vigorous winter bloomer producing two scapes per year.

Registered by Harry Deleeuw Co. (Pty) Ltd., P. O. Box 7, Maraisburg 1700 Tvl. South Africa.

Amaryllis clone **'Basuto'** (Deleeuw, 1977); **A-1024;** U-4 fld; 47 cm h; flower 18 cm across face, dark currant red in color, two scapes from September to December. Deciduous hybrid with 1966 introduction/distribution date.

Amaryllis clone **'Blushing Bride'** (Deleeuw, 1977); **A-1025;** U-4 fld; 39 cm h; light rose flowers are 18 cm across face and carried on two scapes blooming September to December. Deciduous hybrid dating from 1970.

Amaryllis clone **'Bold Leader'** (Deleeuw, 1977); **A-1026;** U-4 fld; 40 cm h; flower pure red, 17 cm across face, carried on two stems blooming September to December; a deciduous hybrid dating from 1969.

Amaryllis clone **'Carnival'** (Deleeuw, 1977; **A-1027;** U-4 fld; 45 cm h; flowers are white striped scarlet, 18 cm across face, on two scapes blooming September to December. Deciduous hybrid dating from 1966.

Amaryllis clone **'Cocktail'** (Deleeuw, 1977); **A-1028;** U-4 fld; 54 cm h; two scapes with white-centered red flowers blooming September to December. Deciduous hybrid dating from 1971.

Amaryllis clone **'Desert Dawn'** (Deleeuw, 1977); **A-1029;** U-4 fld; 57 cm h; Salmon orange flowers carried on two September to December blooming scapes are 16 cm across face. Deciduous hybrid dating from 1969.

Amaryllis clone **'Honeymoon'** (Deleeuw, 1977); **A-1030;** U-3-4 fld; 43 cm h; wine red flowers borne on 2 stems are 18 cm across face and bloom September to December. Deciduous hybrid dating from 1970.

Amaryllis clone **'Intokazi'** (Deleeuw, 1977); **A-1031;** U-4 fld; 60 cm h; pure white flowers 16 cm across face on two stems blooming September to December. Deciduous hybrid introduced in 1969.

Amaryllis clone **'Midnight'** (Deleeuw, 1977); **A-1032;** U-4 fld; 46 cm h; mahogany flowers bloom September through December, are 19 cm across face and borne on two scapes. Deciduous hybrid introduced in 1975.

Amaryllis clone **'Milady'** (Deleeuw, 1977); **A-1033;** U-4 fld; 46 cm h; magenta to magenta-rose flowers are 17 cm across face, produced on two scapes blooming September through December. Deciduous hybrid dating from 1970.

Amaryllis clone **'Shaka'** (Deleeuw, 1977); **A-1034;** U-4 fld; 48 cm h; very dark red (mahogany) flowers measure 18 cm across face. Deciduous September to December bloomer has two scapes and was introduced in 1972.

Amaryllis clone **'Springtime'** (Deleeuw, 1977); **A-1035;** U-4 fld; 43 cm h; light rose flowers are 20 cm across face and borne on two scapes. 1972 introduction date for this hybrid.

Amaryllis clone **'Summertime'** (Deleeuw, 1977); **A-1036;** U-4 fld; 38 cm h; two stems of dark neyron rose flowers, each 17 cm across face. Deciduous hybrid dating from 1968.

Amaryllis clone **'Wedding Dance'** (Deleeuw, 1977); **A-1037;** U-4 fld; 43 cm h; white flowers carried on two scapes are each 19 cm across face. 1970 introduction date for this deciduous hybrid.

AMARYLLID NOTES

Hamilton P. Traub

Alstroemeria x *davisiae* Duncan ex Traub, *hybr. nov.*—Duncan, in *Plant life 33:* 71-72, fig. 18. 1977, *anglise.* Planta hybrida A. pulchellam ♀ et A. pelegrinam ♂ intermedia. Specimens: cult. Sumner, Wash., May 6, 1977. TRA Nos. 1157 (type); 1158 & 1159 (isotypes).

PLANT LIFE LIBRARY—continued from page 68.

SMITHSONIAN CONTRIBUTIONS TO BOTANY. In this numbered serial publication, Smithsonian publishes original monographs dealing with various plant groups. These may be obtained from Smithsonian Institution Press, Washington, D. C. 20402.

No. 32. A MONOGRAPH OF THE LICHEN GENUS BULBOTHRIX HALE (PARMELIACEAE), by Mason E. Hale, Jr., Pp. 29. 7 figures. 1976. Includes a world-level revision, including 29 species of **Bulbothrix,** a primarily tropical genus with the main center of speciation in Brasil.

No. 36. FLORA OF MICRONESIA, 3: CONVOLVULACEAE, by F. Raymond Fosberg and Marie-Hekene Sachet. Pp. 34, 1 figure. 1977. The third part of the Flora of Micronesia, includes a floristic account of the **Convolvulaceae** of Micronesia, with descriptions, keys, synonomy, ethnobotany and citations of geographical records and herbarium specimens.

No. 37. POLLEN MORPHOLOGY AND THE RELATIONSHIP OF PLUMBAGOACEAE, POLYGONACEAE AND PRIMULACEAE TO THE ORDER CENTROSPERMAE, by Joan W. Nowicki and John J. Skvarla. Pp. 64, 200 figures, 5 tables. 1977. The evidence argues against a close relationship of these three families with the **Centrospermae,** and the absence of any pollen types common to these three families further suggests that they are not closely related to each other.

FOLIOSE AND FRUTICOSE LICHENS FROM TRISTAN DA CUNHA, by M. Jorgensen. Det Norska Videnskaps-Akademi. I. Mat.-Naturv. Klasse Skrifter Ny Serie No. 36. University Press. Oslo. 1977. Eighty-four foliose and fruticose lichen species are described; 69 of these species are new to the islands. Four new species are described.

MORPHOLOGY OF VASCULAR PLANTS: LOWER GROUPS (PSILOPHYTALES TO FILICALES), by Arthur J. Eames. 1936. Robert E. Krieger Publ. Co., 645 New York Av., Huntington, New York 11743. Reprint 1977. Pp. i-xviii + 433. Illus.—This reprint of Eames' 1936 text on the morphology of the lower groups, **Psilophytales** to **Filicales,** of vascular plants will be welcomed by the present generation of workers in this field.

CACTUS IDENTIFIER, INCLUDING SUCCULENT PLANTS, by Helmut Bechtel. Sterling Publ. Co., 419 Park Av. South, New York City 10016. 1977. Pp. 256. Illus. Trade Edition $4.95. Profusely illustrated in color, this attractive book is concerned with the care of succulent plants, their propagation, disease control and their scientific names. The species included are from the following families, Cactaceae, Euphorbiaceae, Crassulaceae, Compositae, Apocynaceae, Geraniaceae, Asclepidaceae, Aizoaceae and Liliaceae. Scientific name, Popular name, and general indices complete the volume.

PLANT LIFE LIBRARY—continued on page 104.

3. GENETICS AND BREEDING

AMARYLLIS BREEDING POTENTIALS - 1977

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The diversity of germ plasm now available in *Amaryllis* forces difficult decisions in a modern breeding program. Nevertheless, certain guidelines can be established. Vigor, aesthetic proportions and ease of culture rank high on any list of factors to be considered when using the new germ plasm. If special care is required for the culture of rare, wild forms, one is almost invariably rewarded with primary hybrids of easier culture. It is then far from a game of chance that desired traits can be incorporated into a hybrid population from which new forms can be selected.

Individual considerations are important in selecting hybrids on the basis of aesthetic merit. It seems to me unfortunate that a stereotype has been established favoring the large *leopoldii*-type hybrids to the near exclusion of other forms. This has sometimes influenced breeders to neglect new germ plasm from which these other forms can be developed. The diploid species mentioned below offer the potential for the development of new forms. I admit to personal prejudice when I state my preference for the graceful and charming miniatures which result from hybridization of the diploid species. I have been astonished to learn that relatively few amaryllis fanciers have even seen the miniature species and their hybrids.

GENE SYMBOLS

Sufficient evidence is now at hand to propose two gene symbols for amaryllis. Another can be suggested although evidence is not yet available to prove for certain that the trait, total lack of anthocyanins, exists as a Mendelian gene in the available species.

In diploid species and their hybrids, cyanidins (pink to deep rose) appear to be dominant in all cases tested over pelargonidin (salmon to scarlet). Therefore, the symbol *c* is tentatively used for the gene at this locus.

The midrib leaf stripe of *A. reticulata* var. *striatifolia* is also inherited as a simple dominant. The symbol *s* has been tentatively designated here. Plants of genotype $+/s$ or $+/+$ transmit the trait to progeny in diploid crosses in a Mendelian ratio. Most amaryllis are of genotype s/s, if diploid, and do not have the capacity to produce the stripe.

Hopefully, another gene involving floral pigmentation, tentatively designated *p* may exist in some natural populations. Plants of genotype p/p would lack the capacity to produce pelargonidin. And, since pelargonidin has been shown to be the precursor to cyanidin in other

plants studied, those of genotype *p/p* should appear as pure white, yellow or green. A likely candidate for a species of genotype *p/p* is *A. parodii.* Test crosses have been made among several of Doran's primary hybrid of *A. parodii* in an attempt to establish hybrid plants with this useful genetic trait.

It seems highly unlikely that any species has the capacity to produce the pigment delphinidin, so truly blue amaryllis must be all but ruled out. However, a third anthocyanin may be present in addition to the two previously reported (1). This might be another cyanidin from the visual color. *Amaryllis striata* var. *aracensis* has a purple throat marking in addition to the basic salmon floral color. Pigment distribution in *A. cybister* and its hybrids also suggests some independence of floral color inheritance. The cross, *A. cybister* x *A. striata aracensis,* has been made with the hope that enough pigment will be present in this hybrid that it can be isolated and characterized.

Tetraploids display a lack of complete dominance at the *c* locus. This seems to explain the additional colors found in the tetraploids such as deep blood red. A plant of genotype $+/c/c/c$ may have a mixture of pelargonidin and cyanidin as the floral pigments. Selection for whites among tetraploids also has presented some problems. Often, such whites are plants with a minimum rather than an absence of pigments. Crosses among minimally pigmented plants can then yield some pigmented progeny just through recombination. It seems evident that genetic stocks totally lacking the capacity for anthocyanin synthesis would expedite breeding forms such as a tetraploid yellow.

AMARYLLIS BELLADONNA

Amaryllis belladonna is a common and very desirable garden plant in South Florida and the West Indies. It appears to be far better adapted to tropical and subtropical conditions than the tetraploid hybrids, most of which have been selected under cooler greenhouse conditions. It has a grace and simplicity of line which makes it valuable for landscape planting in these areas. But, the breeding potential of this variant of the species is somewhat limited. Few seeds are produced when pollinated with other diploids, although fertile hybrids result when it is used as a pollen parent, particularly on *A. evansiae* and its hybrids (2).

Annoyed at being unable to set a reasonable amount of seed on the local garden variety in South Florida, I began a search for what might be the other mating type of this species. Pollen was collected from various sources in Dade County, Florida, but no seeds were set. Furthermore, pollen of several South American clones of *A. belladonna* also failed to set on the local plants. My request to friends on Grand Cayman Island for seeds was answered negatively, but they provided flowering size bulbs of a robust clone similar in color and habit to those grown in South Florida. This also had low fertility, setting a few seeds with the pollen of *A. reticulata.* Failures were noted in both directions in attempts to produce seeds by pollinating among plants from the two

sources.

A noteworthy point concerning the South Florida and Grand Cayman *A. belladonna* is the prolific formation of offsets. They can thus be propagated easily without seeds. From what I have learned, other West Indies plants of this species are similar in habit. However, the more fertile clones of the species, from, for example, Brasil, produce relatively few offsets.

One possible explanation for the low fertility in some plants of this species may be that they could have arrived in the West Indies on a floating island or during a violent tropical storm. Other plants in the West Indies and a few on the southern tip of Florida show a close affinity with the flora of South America.

It would seem that the *A. belladonna* which reached the West Indies may well have been separated from their natural pollinating vector. Under such conditions, reproduction by offsets would confer an adaptive advantage. Other species of amaryllis might have arrived in the West Indies without this advantage and were consequently lost.

The last leg of the trip to continental North America probably came about because of the attractiveness of *A. belladonna* as a garden plant. A good guess would be that Spanish colonials transported the species to Florida, at least as far north as St. Augustine. Again, this form flourished because it was easily propagated from offsets. So, perhaps most of the plants now grown in gardens in Florida and other parts of the South came from just a few entries by the early colonials.

Plants propagated vegetatively for long periods of time tend to accumulate recessive mutations. A few are considered desirable such as the mutant forms of the rose 'Peace.' But most are deleterious and lower fertility. This may well have happened with the garden *A. belladonna*.

One plan is to establish a line of this species with the traits of the garden form but easily propagated from seeds. More fertile South American clones will be pollinated with this most desirable form.

It is remarkable that a plant which seems to be propagated exclusively by vegetative means displays so few virus symptoms. Less than 10% of those I observed in gardens had any symptoms of virus infection. Thus, we may find here a source of germ plasm for at least slower transmission of virus than in the cultivated tetraploids.

AMARYLLIS CALYPTRATA

Amaryllis calyptrata has very interesting possibilities but seems to form hybrids only rarely. However, preliminary evidence suggests that this species seems to be avoided by the lubber grasshopper of South Florida. Such grasshoppers often eat the tetraploid hybrids and other species all the way to the bulb plate.

Fortunately, the timely flowering of this species by Caryn Ecker allowed ample testing of its pollen on *A. evansiae*, *A. cybister* and several other species hybrids. All were without success on my part. She, how-

ever, was successful in setting seed on the *A. calyptrata* plant with pollen of the hybrid *A. aulica stenopetala* x *A. fosteri*. The elegant seedlings of this cross are not only vigorous but some inherited the red foliar pigmentation of the pollen parent. Caryn's hybrid may well be the needed gene bridge to allow the genetic potential of this species to be incorporated into the new diploid hybrids. The quarter *A. fosteri* parentage of this hybrid may provide sufficient chromosome matching that further hybrids can be produced with the many species with which *A. fosteri* crosses so freely.

John Cage informed me of his success with Miss Ecker's pollen on *A. aulica stenopetala*. Again, vigorous seedlings resulted. With the many failures observed in attempting to produce hybrids of *A. calyptrata*, this suggests a close genetic affinity between *A. aulica stenopetala* and this species. The bad news here is that I placed the Cage hybrid outdoors only to find that the seedlings were attacked by the grasshoppers, although none were completely lost. So, if the species has a lack of appeal for these grasshopper beasts, it may be recessive in nature.

It would be most interesting to determine whether or not the unique fragrance of *A. calyptrata* is related in structure to the very pleasing fragrance of *A. brasiliana* and several other species. Even though considered objectionable by some, the intensity of fragrance in this species might be the path toward breeding amaryllis as fragrant as the almost overpowering *Hymenocallis palmeri*.

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THE ROLE OF **AMARYLLIS** SPECIES IN FUTURE COMMERCIAL HYBRIDS

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The English, Germans and Dutch used a small fraction of the total number of *Amaryllis* species at the start of their very long breeding programs. The various large-flowered strains that evolved from those programs are now really quite similar, in my opinion, even though the color range is fairly wide. The traits of the wild ancestors are now difficult to identify in the hybrids.

The present-day possibility of introducing some of the desirable traits of the various species into the large hybrids is a perennial dream of breeders. For instance, we would like to add: (1.) The yellowish color of *A. evansiae*, *A. parodii*, and *A. aglaiae;* (2.) The vigor of *A. papilio*, *A. calypstrata*, and *A. aulica*, var. *stenopetala;* (3.) The fall-blooming habit of some of the above; (4.) The dotted segs of *A. pardina* and *A. lapacensis;* (5.) The color of *A. doraniae*, and (6.) The water

tolerance of *A. angustifolia*.

It is important to observe that not one of these dreams has succeeded, mainly because of differences in chromosome counts and other genetic incompatabilities. Many viable crosses have been made, but the desired trait of the species has been either partially or fully suppressed or diluted in the progeny. My clone "Great Pumpkin" is 1/4 *A. aulica* (a vigorous variant) but it neither is fall-blooming nor does it resemble *A. aulica* in other ways. Perhaps the greatest success has occurred in the various hybrids of *A. evansiae* and "Dutch" clones—several generations of breeding have produced pretty seedlings in pastel shades. However the flowers are neither large, yellow, nor of good form. Until breeders produce compatable tetraploid forms of the most desirable species or species hybrids, this simple-minded approach looks very fruitless.

People who can raise extremely large numbers of seedlings should continue to hybridize species x Dutch-crosses, I think, to try to achieve the improbable breakthrough. Also, some really good technical work is being done to produce tetraploid forms of species, and these or their hybrids will be available sooner or later to the amateur breeder. In the meantime, I suggest a different emphasis in amateur breeding involving *Amaryllis* species: that is, the progressive development of species x species hybrids.

A cybister hybrids have much potential, for instance. The first generation, or primary hybrid, of *A. cybister* x *A. evansiae* is very easy to grow and flower, and the four pretty yellowish blooms have little pigmentation. The bulb is about 2" in diameter. The segs are narrow and graceful but not as spidery as in *A. cybister*. Further generations should be selected either for the *cybister* form or for wide, regular segs. The deepest yellow colors should be selected, as well as the largest plants that grow and bloom easily. In ten years or less, one should have an excellent garden or pot plant, perhaps with much larger flowers than either original ancestor.

The whole aulica group could be interbred for large vigorous bulbs with large, brilliant flowers that bloom in the fall—but not if the breeder stops after one or two generations. I suggest that *A. papilio*, *A. calyptrata*, *A. aulica*, variety *stenopetala*, and any other species that cross easily with these be interbred while continually selecting for the desired traits. Larger flowers would almost surely evolve in the recombinants. This is obviously a ten-to-twenty year project, but it is better than miscellaneous crosses that are not bred further, and you might find that part of the work has already been done for you.

Selected hybrids of *A. angustifolia* endure much water while growing and much dehydration while dormant. In limited numbers, I am further breeding these for large yellow flowers of *Sprekelia* form while retaining the good growth habits. The other original parent was *A. evansiae* x *A. anglaiae*. Later, the best plant from this program could be crossed with the best of the *A. cybister* hybrids to obtain hybrid vigor in large-flowered yellow flowers of *Sprekelia* form. Only those that

bloom easily from dormant bulbs would have commercial value.

The enterprising hobbyist can think of other logical projects. As I see them, the following principles are appropriate: (1.) Start with a group of species having rather definite desirable traits. (2.) Intercross as many species as possible, but only those that are strongly interfertile, ones that produce many viable seeds. (3.) Limit the number of separate projects severely, so that many seedlings and many generations can be covered. (4.) Select to meet preset criteria. If one set of criteria is unproductive, write down another set, if possible.

What kind of new species hybrids would be successful commercially? Some modeled after the Dutch hybrids? No, unless the breeder can work for 150 years. I think salable new species hybrids will meet a practical need and be distinct and different, like tulips or daffodils. If *Sprekelias*, for instance, could really be grown, harvested, shipped, and then brought into *lasting* bloom by the novice, all with ease and dependability, then the market for them would be many times the present one.

Editorial Note.—Observations in support of Dr. Cage's thesis: Unattractive greenish-yellowish and yellowish segregates sometimes appear in large progenies of the Mead-strain large-flowering *Amaryllis* hybrids. These are destroyed by the breeder, but this is mistaken. Such yellowish segregates although unattractive when crossed with the yellowish-flowering *Amaryllis* species—*A. evansiae, A. parodii* and *A. aglaiae* could apparently give hybrids which when graded up by selective breeding could finally result in the real yellow large-flowering hybrid *Amaryllis.*

The large-flowering white *Amaryllis* hybrids with the *yellowish throat* should also be used in crossing with the yellowish-flowered *Amaryllis* species. In the two cases cited, it is the large-flowering habit combined with yellow possibilities in the large-flowering member of the cross that is so important in attempting to reach the final goal more quickly by the repeated and repeated intercrossing followed by backcrossing on the large-flowered member of the cross, and careful selection.—*Hamilton P. Traub*

A STEP TOWARD A HYBRID YELLOW **AMARYLLIS**

Richard E. Tisch, *20516 Clark St., Woodland Hills, Calif. 91367*

HYBRIDIZATION HISTORY

On August 19, 1972, Mr. Leonard Doran brought to the meeting of the Southern California Hemerocallis and Amaryllis Society a potted *Amaryllis* species in flower. It was, according to my notes a clear yellow'', with a perigone 2 cm in diameter, with a tepaltube approximately 5 cm long. As I recall, its umbel was held upright on a scape approximately 45 cm long and had at least four flowers. Mr. Doran generously permitted me to take pollen home from one of the flowers. I refrigerated it and, on 22 August 1972, applied it to a Peru-

vian *A. belladonna* which was carefully de-anthered.

On 24 September 1972, 68 seeds were gathered. Germination inside the protection of my screenhouse, under Gro-Lux lamps, was very good, and 60 seedlings were transplanted to pots. At that time, all had long, strong roots and most had three leaves, 10-15 cm long. In the winter of 1973, 59 remaining were brought into the house in my den and continued to receive special care in a Floracart under closer Gro-Lux lamps. In April and May of 1974, all were moved out to benches in semi-shade and, when they were considered to have "hardened off", were set out in beds with gravel under and around the bulbs. All had firm bulbs, ovoid in shape, with large main roots and long, strong feeder roots.

Fig. 20. Creamy-pink hybrid **Amaryllis** produced by R. E. Tisch. See text for description.

In June of 1975 they began flowering. Since then 20 have flowered. Growth varies from vigorous to weak, some having dwindled and died. Offsets vary from plentiful to none. Coloration, size and persistence of foliage vary markedly (see Description). When I discussed the results with Mr. Doran, he voiced his opinion that I could not have seen a "bright, clear yellow" flower on his plant, and possibly was seeing what I had hoped one day to see. To the best of his memory, he had brought in a greenish-flowered plant which he recalled as possibly his "Number A-15", as yet unidentified or named. So be it.

DESCRIPTION

Definitely in the Elegans Group. Leaves 2-5 cm broad, 20-35 cm long, sometimes persistent to a point of being evergreen in Woodland Hills, California, sometimes disappearing during the winter, the former fully developed prior to flowering, the latter developing to full size only after flowering. Perigone 8-12 cm long, 5-7 cm in diameter when expanded. Tepaltube green, 2.5 cm long, obscure or absent paraperigone. Stigma capitate (obscurely trifid). Stamens shorter than perigone. Tepalsags yellow-green at base, background coloration from white to apricot, edges from cream through burnt orange to bright red. Scape 20.5 to 50 cm long, gracefully tapered, never weak. Pedicels cylindrical, 4.5 - 6 cm long. Umbel 2 - 5 flowered. Spathe-valves green, lanceolate. Setepalsegs and petalsegs not significantly different in size or coloration in the cream-toned and apricot-toned flowers, but setepalsegs are wider in the orange-toned and red-toned flowers (like the maternal parent) and in those the lower petalseg is noticeably narrower. Anthers small, oblong, from solid white or yellow to red-pencilled white. Bulb from ovoid to globose, 3 - 6.5 cm in diameter, neck short, tunics brown, short or no apparent rhizomes to offsets, thick fibrous roots.

CULTURE

Grows well in either pots, indoors or outdoors, or in outdoor beds. All have been grown only with gravel under and around the bulbs. They obviously prefer semi-shade to deep shade or full sun in the Woodland Hills, California climate. All have done well with their roots in rich, loose soil with a goodly proportion of humous. Feeding in done with weak fish-base liquid fertilizer solutions weekly. They respond to generous watering, provided the drainage is fast. After continued growth all winter in the screenhouse, they flower very early in the Spring, and many times again in the mid-to late-Summer. Two to three scapes per bulb are common. Their aspect is pleasing, but they definitely are in the more modest color ranges, none being strikingly brilliant. So far all have been self-sterile and sterile to any attempted inter-specific crosses attempted. I personally find this plant a welcome relief from the big, flat-faced, blatant commercial Amaryllis. In my garden and among my potted plants they are pleasing companions to my *A. striata*-commercial crosses (which I designate as my "Pelagrina" group, *A. vittata*, *A. belladonna* and *A. petiolata*.

BREEDING DOUBLE **AMARYLLIS**

JOHN WADE DEME, *Route 5, Box 236, Kinston, North Carolina 28501*

During high school, I was fascinated by all *Amaryllis* species and hybrids. Whether it was the bulb size or the huge flower stalk, the fascination continued when I went to work for Park Seed Company as grower in 1965. While there, I saw a 'Helen Hull' double amaryllis

in bloom and was, to say the least, impressed. After checking books and catalogs but finding very little mention of double *Amaryllis*, I decided to try some crossing on my own. I crossed 'Helen Hull' with 'Park's Apricot', a single, and when the first seedlings began to bloom, I saved everything with more than six petals. The only colors in my crosses were shades of orange and red.

I joined the PLANT LIFE SOCIETY in the early 70's and read some of Len Doran's articles on his double *Amaryllis*. I began to correspond with him and he made suggestions as to what I should try. I sent slides of my doubles to Mr. Doran and he gave me his comments on each one. Along with the good advice he has sent during the seven years we have corresponded, Mr. Doran also sent some pollen from his 2R5 which I crossed with several of my semi-double lines. In less than two years, I had my first blooms. Following Mr. Doran's suggestion, I dumped plants that did not come up to standard: I was looking for two-toned colors with 15 or more petals and a hose-on-hose petal arrangement. Many had the petals clumped together in the center of the flower (not a very orderly arrangement) and these were dumped. One of the original parent apricots made a great many offsets becoming grassy at times. This characteristic seems to carry on in later generations so perhaps there is a genetic basic for this. The bulbs I have selected over the years make many offsets but do not get grassy looking.

I do all my crossing by taking pollen from my best doubles and pollinating nicely-colored single plants. The color range resulting from Mr. Doran's lines and my lines is wide: solid salmon; light pink; bright orange with pure white center; and many different picotee types (some are almost pure white, while others are almost pink or red with white petal markings).

The percentage of good doubles which result from crossing is very low and poor plants are discarded (they make nice yard plants; my yard is full of culled bulbs). When a new seedling blooms for the first time, it is given a number and allowed to bloom a second time. If it fails to come up to standard the second time, out it goes. One thing which must be remembered about double *Amaryllis* is that the degree of doubleness can vary at different times of the year. Winter blooms are more double on some varieties, while others seem to be unaffected by the temperature.

My *Amaryllis* are greenhouse-grown in a pine bark and sand mixture; the plants receive a constant feed of 200 ppm 20-20-20 and trace elements. Plants grow in full sun all year with no rest period. Watering is done only when the mixture becomes quite dry. Getting the foliage wet seems to encourage red fungus growth on leaves. In the fall, all the old green foliage is cut off to remove any disease or insects. I spray for mites and mealybugs when I notice them. Large bulbs are grown in two-gallon nursery cans and are repotted in the same pot every two years or after offsets are removed. This past summer, I grew seedlings on capillary mats in a bark mixture with "osmocote"; not one plant got root rot. Every three or four months, I drench all plants

with "benlate" and "turban" combination as a preventative. I don't follow the book growing my *Amaryllis,* but I have had good results for the past six years with this method.

This summer I sent slides of some of my doubles to several Dutch growers. Several of them requested trial bulbs, which I have sent, and they are now growing these. I'm hoping they like some of the bulbs enough to buy them.

PLANT LIFE LIBRARY—continued from page 94.

A TERRARIUM IN YOUR HOME, by William White, Jr. and Sara Jane White. Sterling Publ. Co., 419 Park Av. South, New York City 10016. 1976. Pp. 92. Illus. Trade Edition $4.95. The terrarium is described as a miniature indoor garden enclosed in glass, creating a tiny artificial **biome,** or ecological zone. The subjects treated include selecting a container; preparing the soil; planting care; gathering plants; light, temperture and water; communities; synergism and symbiosis; some native plants; plants and animals; and the history of terraria. An index completes the volume.

DISCOVER THE TREES, by Jerry Cowle and Mike Abderson. Sterling Publ. Co., 419 Park Av. South, New York City 10016. 1977. Pp. 96? Illus. Trade Edition $4.95.—This book is dedicated to the young. Sections are devoted to Mother Nature's Bag of Tricks; lots of things to do in the woods; seven famous trees of history; questions to stump your friends and family; and where to find the trees. An index completes the volume. Highly recommended to the young.

WHAT TO MAKE WITH PINE CONES, by Genevieve Ploquin and Boris Toplitzky. Sterling Pub. Co., 419 Park Av. South, New York City 10016. 1976. Pp. 32. Illus.—This charming little book, translated from the French, is concerned with the construction of various objects with pine cones, including Fir Tree Plaque; a shepherd, his dog and his sheep; a fish, a wading bird and an owl; dried bouquet; a bison; and other interesting objects with pine cones. An index completes the volume. Highly recommended.

THE PLANT BUYER'S HANDBOOK, by Richard E. Nicholls. Running Press. 38 S. Nineteenth St., Philadelphia, PA 19103. 1976. Pp. 142. Illus. $3.95 soft cover.—For all house plant addicts this is a handy book to have at hand. The subtitle, "A consumer's guide to buying house plants", does not accurately describe the contents of this paperback book of 142 pages. The text tells the prospective buyer not only how to shop for house plants, but also the kinds of plants you should purchase after considering the environment in which they will be expected to thrive. It also explains the basics of plant care, which are necessary to grow and maintain healthy house plants. The book has several useful features including a glossary of terms, a bibliography, a list of suppliers, and a list of plant societies. A distinctive and innovative chart showing light, temperature, and humidity needs of the various house plants, and their ease of growth, is probably worth the price of the book. This book is a "must" for both the neophyte and experienced house plant grower. **Thomas W. Whitaker**

4. AMARYLLID CULTURE

[ECOLOGY, REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

GENERAL AMARYLLID REPORT—1978

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The past year has been devoted to contacting amaryllid growers throughout the world, acquiring species, and learning more about the cultural needs of species already on hand. A few words about each of these endeavors may be useful.

Contacting amaryllid growers by correspondence for the purpose of obtaining desired species can be both highly rewarding, and highly frustrating. The rewards are twofold; meeting and exchanging thoughts with growers having a common interest, and acquiring elusive plants. This is often a lengthy process, however. The most difficult task is probably to locate the particular individual who is growing the desired plant. The first logical step is to make a contact in the country where a species is naturally found. Sources written in the past have included botanic gardens, foreign consulates, nurseries, universities, and individual growers. Names of individuals may only result from information provided by institutions, or by articles such as those appearing in *Plant Life*, and other journals. Individual growers in other parts of the world are also sometimes discovered by growers in this country. Hopefully, the word can then be passed on to those interested. Unfortunately, some authors will not respond to letters. Success with correspondence to botanic gardens has been good in the past. Some of these gardens have plant sales (often for members only). Others are willing to exchange species (often only with other botanic gardens but in some cases with individual collectors). If you are able to obtain a response from a botanic garden, they are usually helpful in providing information about a species. This may involve a referral to a nursery, or to a private collector. In some cases a deadend is reached, temporarily, with luck. With some creativity the deadend may be bypassed.

Consulates have been contacted when a doubt existed as to the proper administrative agency to write in a foreign country. A letter to the Australian Consulate in New York has provided the name of an individual involved with agriculture on Norfolk Island. This correspondence is still in process (some question exists as to the frequency of mail delivery to this island in the South Pacific, approximately between Australia, and New Zealand). It is gratifying how precise the consulate can be in providing the name of a specific individual working in a particular field. A current letter has been directed to the same consulate in an attempt to make a contact on Lord Howe Island, off the coast of New South Wales several hundred miles. In this case the desired species is the elusive *Dietes robinsoniana*. It is just a shot in the dark but only time will tell as to the success of this attempt.

Letters to U.S. government agencies are written for the same purpose as those to foreign consulates; to pinpoint a prospective source. A letter to the Trust Territory of The Pacific Islands Agency, based in San Francisco, led to referrals to and individual in the Marshall Islands. A letter to this person was not answered. This is par for the course. Another letter to San Francisco referred me to an individual in the Mariana Islands. This correspondence is still in process, and may never develop into anything but the Trust Territory of the Pacific Islands Agency always responded within five days from the date that my letter was mailed to San Francisco, possibly a record for the government.

Often the last link in the collection by correspondence chain is the nursery or individual. It should be said here that an import permit from the U.S.D.A. is a necessity even though bulbous plant importations are not subject to import restrictions. Some countries, such as Australia, still require a U.S. purchaser to send his green and yellow import label to the seller. The final reward is the receipt of a rare species, long lost to cultivation, or never before found in cultivation. It can be seen that this may be a lengthy process with a low ratio of success. However, the benefits far outweigh the drawbacks. I am still learning much about this correspondence/ acquisition technique, especially in the areas of reference material, lists of botanic gardens, etc.

It is interesting to review the early issues of HERBERTIA, and the advertisements by amaryllid growers. This policy has long been abandoned, unfortunately. This is undoubtedly due to the lack of nurseries who specialize in this sector of the bulbous plants. When a nursery is found that offers botanical species, it is normally only a small portion of the firm's business (an economic reality). Still, it can be disheartening to the amaryllid grower to thumb through a journal such as that published by the Bromeliad Society, and see the number of nurseries that feature bromeliads. If only a fraction of that number existed to specialize in the bulbous plants!

Continued exploration, and introduction of wild species is needed. This always benefits both the species grower, and the hybridist. There are many intriguing species that have either disappeared from cultivation, or have yet to be introduced. A list follows of some of these plants:

Calostemma album
Clivia gardenii
Crinum brachyandrum
Crinum carolo-schmidtii (**C. occiduale** Dyer)
Cyrtanthus epiphyticus
Cyrtanthus falcatus
Cryptostephanus—all species
Eucrosia—all species
Eurycles amboinensis
Eurycles cunninghamii
Paramongaia weberbaueri
Phaedranassa—all species
Urceolina—most species of subgenus Eucharis

Readers will undoubtedly see species that they are currently cultivating. I would certainly be interested in knowing which species they may have. This list represents just a fraction of the species that should be reintroduced to cultivation, and was assembled from a fast scan of the various genera of the Amaryllidaceae.

The point is that the ground has barely been broken in the area of amaryllid exploration, and cultivation. When one considers the individuals who have devoted their lives to this field, it only goes to show what an evergrowing field this is. No other bulbous family can compare to the Amaryllidaceae for beauty, diversity, and potential. Amaryllid growers may be artificially divided among hybridists, those growing both hybrids and species, and those growing species only. I belong to the latter group. Those who are interested in the cultivation of botanical species know what the feeling is to acquire a new species. Those who have done it on their own, in the field, experience this feeling even more so. It remains for these field collectors to continue their work so that all growers may be benefitted.

Everyone interested in cultivating bulbous plants might try acquiring plants by correspondence. There are people all over the world who are waiting to hear from you. Those who enjoy collecting trips should continue to do so. It is only by observing a species in it's natural habitat that environmental factors (exposure, soil, nutrients, water, air movement) are best anlyzed. This analysis benefits all.

AMARYLLIS CULTURE

E. M. Beckham, *Box 318, Baton Rouge, La. 70821*

Many formulas have been given on the culture of *Amaryllis* and I am sure most of them, as applied, have given very good results. If you have had good results from one of these formulas please continue to use it, as I believe nothing replaces success. The method and experience that I pass on to you have been instrumental in my growing large, beautiful and healthy amaryllis. Horticulture is not my profession, I do this as an amateur like most amateur gardeners. I have no equiptment for sterilization of the soil, ways of controlling temperature, proper lighting etc. My method for potting amaryllis is as follows: equal parts of a good sterilized potting soil, course builders sand (sold as play sand in most nursery and hardware stores) vermiculite to which I add to each 6 inch pot of this mixture, one tablespoon of bone meal, one tablespoon ground oyster shell or dolomite, one tablespoon osmocote (a slow release fertilizer which will feed for three or four months as you water). Mix the above ingredients. The components for this mixture can be found in any feed store or nursery. All of these materials have been sterilized and this is important because of control of fungus diseases etc.

I never use pots larger than five or six inches because *Amaryllis* grow better when pot bound and these sizes take care of bulbs from 24 cm 34 cm. If your bulb is larger you will of course use a larger container.

In potting, place some old pot pieces in bottom of pot for drainage. Hold bulb in one hand applying prepared soil mixture leaving about one half of bulb above soil level. Do not pack soil, apply very little water until leaves or scapes begin to show growth. During growing

season apply a good liquid fertilizer about every two or three weeks.

I grow *Amaryllis* in both clay and plastic pots from year to year, repotting each season. I also remove some bulbs from pots as soon as they have finished blooming and plant them in outdoor beds.

In very cold sections of the U.S. growing *Amaryllis* in outdoor beds is almost impossible, however you can dig your bulbs before freezing weather sets in, store them for winter protection for a period of thirty days or more, then begin with the same potting procedure as explained above.

We here, in the deep south seldom have weather with temperatures below twenty degrees, and can grow *Amaryllis* in outdoor beds very successfully. I mulch with bagasse (sugar cane pulp) and pine straw. Both of these materials do an excellent job. Bagasse however, will protect your bulbs much better in extreme cold weather.

I hope this information will be of some help especially to those of you who are not too familiar with *Amaryllis* culture.

Beautiful *Amaryllis* grown with proper care is really a sight to see during blooming season. I would suggest you attend a local *Amaryllis* show so you can see just how beautiful they can be.

THE ZEPHYRANTHEAE REPORT, 1977

MARCIA C. WILSON, *Chairperson, Zephyrantheae Committee*
Brownsville, Texas 78521

The spots covered in this report are undoubtedly among the most beautiful in Mexico. They are now missed by most travelers going on the new highway from Victoria to San Luis Potosi en route to Mexico City. In avoiding the mountains for speed, the travelers really miss a lot.

"Two collecting trips to Mexico in one year? That's indecent!" This was the reaction of Fred Jones when my mother and I recently spent an afternoon visiting with him and his wife Emma in Corpus Christi. The Jones' backyard was spotted with various Texas yellow rain lilies, brought into bloom by a sprinkler. Most were *Z. smallii* (Alex.) Traub, but a few *Z. jonesii* (Cory) Traub and *Z. refugiensis* Jones were in evidence. Well, when you live on the border of Mexico, sometimes an extra trip or so will present itself. An easy afternoon's drive will put you into facinating territory, no matter which direction you take upon leaving the border.

Ciudad Mante was our headquarters for both trips. It is about five or six hours from Brownsville and convenient for many side trips. Following a description of some of these trips, I will review (from a gardener's angle) some of the various Zephyrantheae that have been observed, collected and studied in various depts from the area covered.

I. BROWNSVILLE TO CIUDAD MANTE

Many of the Texas *Zephyranthes* range into northern Mexico. The most notable in the area of this trip are the common white *Cooperia*, *Z. chlorosolen* and *Z. pulchella*. (The white *Cooperia* has many

synonyms. See *New Synonyms—Amaryllidaceae*, by Pierfelice Ravenna, PLANT LIFE 1977, page 37.) The white rain lily might appear in season soon after leaving Matamoros and extends in a number of different directions. A new north Texas location for this species has been reported to me by Dennis M. Speed within the city limits of Sulphur Springs, Texas on low grassy land owned by a local milk producer. This town is northeast of Dallas. The species has been located earlier by Dr. Charles M. Crane 8/10 of a mile away north of State Highway 67 near the MKY Railroad. Dr. Crane also located an "aquatic" form of *Z. pulchella* near Soto La Marina, Mexico, 0.2 miles south of the intersection of Highways 9 and 180. It had quite a nice flower, borne on very tall scapes. Bulbs were growing in 6-8″ of water near ferns and other moisture loving plants. The *pulchella* found around Mante and on the Mante-Tampico highway are rather small and pale in color.

II. CIUDAD MANTE TO CUIDAD MAIZ

We saw disappointingly few rain lilies in bloom on either trip. It was very dry in late May on the first trip and the early spring bloomers were already dormant. Our trip over the July 4th holiday should have given us a greater show, but rains had been late and little foliage was up. The countryside was lush and green in July, but many of the plants and vines had not yet come into mass bloom. Aside from various flowering trees and a few shrubs, most of the spectacular color was observed in private gardens in villages along the way. For collecting purposes, it is wise to take speedometer readings at all towns and small villages and at all major landmarks such as rivers. South of Mante on Highway 85 is a short dry mountain range with some very large and old specimens of *Beaucarnea recurvata*. Their crowns of yellow or mauve dot the mountains and may be seen for miles around. Flowers on branched inflorescences are actually greenish white, but seed capsules change distinctively in color as they mature. *Hectia* is abundant in crevices on almost vertical mountain faces. We turned right at Antiguo Morelos on to Highway 80. A day of each trip was spent on this interesting mountain road between Antiguo Morelos and Ciudad del Maíz. Distance between Mante and Maíz is only 144 miles round trip, but elevation reaches near 5,000 feet between El Naranjo and Maíz and one should never drive after dark in Mexico. This precaution is dictated by stray animals and uncertain road conditions and advised by all travel agencies. Unleaded automobile fuel is also available only in major towns.

The roadside collecting area for *Zephyranthes* sp. Clint M-522 was dry and deeply cracked the first trip, but we found two or three of the cream colored flowers in July. Both cream colored and yellow flowers have been observed in the drainage ditch next to the road as you pass through a valley before you reach the gorgous El Naranjo river. In years past, mass bloom has been spectacular. The short drive to the El Salto waterfalls is very worthwhile after the summer rainy season

has started. Commerce and farming had stripped the entire area of Cycadaceae between my last trip in 1970 and this one in 1977. I had particularly wanted to collect a special dwarf form of *Zamia fischeri* which is sometimes found in the wet mountains beyond El Naranjo. Always rare, it is about non-existent now close to the road. After any number of stops on both trips, I finally found a small plant that had regenerated from a broken underground trunk. Years earlier, my parents had witnessed the disappearance of special orchid species in this area. It happened in less than five years between the late '40s and early '50s. Thousands of the plants were stripped from the oak trees because of a market for the blooms in Mexico City. This is still a facinating mountain rain forest with an abundance of *Tillandsias* in the oak trees and ferns, begonias, flowering shrubs, vines, etc. growing in the rock crevices along the road. We collected a purple native *Achimenes* near El Platanito. Mother had seen a specutacular display of bloom on these plants the previous July, but they were just coming into bloom this year. It was close to this area and near another village called Los Abritos that I found the first forest *Zephyranthes* I had ever seen. The flowers were pink, small and rather ordinary, but what a curiosity to find them blooming in such deep shade! Of course, all *Zephyranthes* in this wetter wooded area grow in part shade.

If we missed the reason for our first trip in late May—to find *Zamia fischeri* before lush undergrowth covered them—we also missed the reason for a duplicate trip in July. This was to see masses of *Tigridia* in bloom. We found leaves, but not a single bloom.

Puerto de Lobos is a valley between the wet and dry sides of the mountain range. It was right above here that I was startled to see white *Zephyranthes* in bloom. Sure enough, it was the white *Cooperia*, Clint M-292. I knew this closely resembled *Z. traubii* (Hayward) Moldenke that I collected frequently in Galveston, but this was the first bloom on 292 that I had seen in the wild. Bulbs were growing in crevices and on the usual rock ledges, but appeared to be identical to *Z. traubii* (bulbs, flowers and seeds). There is, however, an important difference in the 2n chromosome number. *Z. traubii* is an unusually low number of 24 (Dr. Walter Flory's count reported in PLANT LIFE 1975, page 82) and Clint M-292 is the more common number of 48 (Dr. Raymond Flagg's count in his PhD Dissertation, INVESTIGATIONS IN THE TRIBE ZEPHYRANTHEAE OF THE AMARYLLIDACEAE; The Alderman Library, University of Virginia, May 1961, page 62). Growing along with this species, but not in bloom, we found *Zephyranthes* with very large bulbs and very wide leaves (1¼" or more). This is probably Clint M-155 or similar.

From Puerto de Lobos south to Cañon de Borregos the climate changes quickly to dry. It is in this area before the short descent into Ciudad del Maíz that my parents collected so many different rain lilies, including *Z. clintiae* Traub. (*Zephyranthes Clintiae* sp. nov., Hamilton P. Traub; PLANT LIFE 1952, pp. 74-76. "Exploring for Mexican *Zephyranthes*," Mrs. Morris Clint; PLANT LIFE 1952, pp. 77-79.

"Collecting Amaryllids in Texas and Mexico;" Mrs. Morris Clint; HERBERTIA 1957, pp. 10-22.) It must take a great deal of rain to activate these dry land bulbs and I'm sure that most had bloomed in April and early May. At any rate, we found next to nothing in this area on both trips. We walked quite a distance near Cañon de Borregos and collected just a very few bulbs in leaf. I dug several attractive small species of cacti, although I understand there are more numerous interesting species from Maíz to Huizache. Dr. Thad Howard once found a lovely large white *Zephyranthes* growing under oak trees in a colony with similar pink ones. This was just the other side of Cañon de Borregos, near the top of the rise. We stopped for a cold drink along in here and saw absolutely nothing but some bright orange mushrooms that would have been beautiful to photograph. Most of the rain lilies here are in shades of pink to dark rose-red in a variety of shapes and sizes. Heaviest bloom should be April to mid-May, with foliage growing later with the heavier June rains. This area has been fenced for cattle and goats for the last five years or so. I hope this has not disturbed the rain lily population.

Fig. 21. **Left, Zephyranthes,** sp. Clint M-375, Tamazunchale, Mexico. **Right, Zephyranthes insularum** (West Indies), from a garden in Valles, Mexico; and **Lower center,** foreground, **Zephyranthes macrosiphon,** a large form of Clint M-30, south of Tamazunchale, just over state line of Hidalgo, Mexico. Photo by Mrs. Morris W. Clint.

III. GOMEZ FARIAS, "RANCHO DEL CIELO"

Somewhat north of Mante, beyond the town of El Limón, we turned left back toward the mountains for the short drive to Gomez Farias. Beyond the town is an unpaved road (4-wheel drive is necessary) to the late Frank Harrison's "Rancho del Cielo." The property was

deeded to Brownsville's Texas Southmost College and is quite an attraction for bird watchers, plant lovers and photographers. A pretty rain lily, pink with a white center, comes from here. This is Clint M-522, a *Z. macrosiphon*-type. Gomez Farias is a narrow settlement on a ridge up the mountain and is a particularly charming and beautiful village with bananas, mangos, avocados and even a coffee crop. The gardens, no matter how small, are ablaze with color of cultivated plants. Bundles of *Chaemadoria* leaves, fresh from the jungle above, were being loaded on a truck bound for city florist trade. The road up to the village is somewhat dry, but plenty tropical looking during the rainy season. In late May the *Bromelia* species was in bloom and the maidenhair ferns were beginning to come out. In July, the numerous vines were beginning to bloom and we were relieved to see a few *Dioon edule* growing in the rocks with *Bromelia.* The *Dioon edule* is such a common cycad in Mexico, it is a shame to have it removed from the roadside to satisfy the wants of the commercial collectors. Back on the road to Maíz, out of sight in the woods, we found a pile of 25 of more *Dioons* full of rot and bugs. They must have been too small.

A little further north of Mante is a paved road to Ocampo. This is a rather dry, uninteresting mountain drive. With a four-wheel drive, I understand the gravel road from Ocampo to the lumber camp north of Gomez Farias is extremely interesting. This passes through another rain forest.

IV. CIUDAD MANTE TO TAMAZUNCHALE, CIUDAD VALLES

For our second trip we were given the name of a man in Mante with a truck. Since we wanted to go on the old graveled road to Xilitla, a number of miles south, this was a ridiculous business proposition, but the man was well recommended. It was even more ridiculous when, over an hour late, two young near-relatives showed up in a different truck. We lost a prime four hours of daylight time, mostly spent along the road in the hot sun waiting for the broken-down truck to catch up with us. For me, however, it was my first visit even a short distance up this road, and worth anything for the glorious experience. The sixty miles to Ciudad Valles on Highway 85 is a rather uninteresting trip, but the city is a large bustling community no longer dependent upon tourist trade. In May, 1971, Dr. Thad Howard found a tiny white flowered *Zephyranthes* a mile or two north of the city. "It had a pinkish exterior flush (like most whites) and almost had the texture of crepe-paper. Really a weency-mite and hard to see even when staring directly at them a few feet away. It was much like *Z. verecunda*, but a bit smaller, and it had a fair pedicle." Small light pink *Zephyranthes* were found in 1962 by Mrs. Robert H. Steude of Houston, Texas. These were growing south of Valles near the Hotel Covadonga by the river. I believe the common white *Cooperia* grows here too. One of the most important discoveries, however, is Dr. Howard's "Valles Yellow". This light yellow *Zephyranthes* species was found by him in July, 1953 blooming in a roadside ditch about 24.5 miles south of Valles. This rain lily is extremely adaptable and is as everblooming as *Z. smallii* in

south Texas. If we had not been pushed for time, we possibly could have found some in leaf, but they are rather messy to dig when found in standing water. The paved road to Xilitla turns right about 22 miles before reaching Tamazunchale. I doubt that we would have found bloom on this trip, but several pink *Zephyranthes* grow near this town. Clint M-30, identified as *Z. macrosiphon* by Dr. Traub, is a large and beautiful pink rain lily which may be found both north and south of Tamazunchale. My mother had collected a very few of these in scattered bloom in July 1976. I understand that a hillside of these in bloom is really a sight to look forward to, and many variations in color shade, size and form may be observed in a large colony in bloom. In 1953, Dr. Howard found his 53-3 "Crepe" north of Tamazunchale. This one, somewhat related to the *Z. clintiae* complex, has pink flowers with a white center and keel, rather small with a crepe texture. Another charmer is Clint M-375, which was collected by L. E. Guerra of Mission, Texas in 1953. A number of these bulbs were found blooming along the banks of the Rio Moctezuma east of the town.

Vegetation south of Valles becomes increasingly interesting as the elevation rises. Valles is noted for its great stands of bamboo, which have been somewhat reduced in number by disease in recent years. A number of beautiful tropical flowering trees, fruit trees and palms have been introduced into this area of Mexico, but there are also some very unusual things that are native. The Palo del Rosa *(Tabebuia pentaphylla)* had been spectacular in April, we were told, and we saw a very few blooms still in July. Large stands of *Sabal mexicana* are disappearing from the roadside, but a few of these and *Acrocomia mexicana* may be seen. There is a large tree with purple flowers growing along the highway and any number of legume and daisey trees of different colors. I hadn't realized that several of our local popular small flowering trees were native to drier sections here: the yellow-flowered Experanza *(Tecoma stans)* and both the yellow and orange Chinese oleander *(Thevetia)*. The population near Tamazunchale has increased and the patterns of small cultivated areas and land erosion form a tapestry on the shear mountain sides all around. It is an unforgettable sight.

V. XILITLA

We stopped at the intersection of the Xilitla road to wait again for our truck and I investigated a small shady cove nearby. The walls were lined with moss and two kinds of *Peperomia*, one a little vine with tiny thick round leaves that I had never seen before (like a plain leafed *Peperomia prostrata*). All of my life I had been hearing about "the old Xilitla road" from different people, and all of the superlatives fit this small area so close to Texas. We followed the new paved road for a short distance and turned to the right on a gravel-stone road which leads past the castle. This is where we had to stop, picnic and watch our time. The castle. It is actually a multileveled stone structure with cement pillars, arches and decorations built by an Englishman in the

1960's. The building, raising up in the jungle like part of the mountain-side, already looks as if it has been here for hundreds of years. It is so unreal and architecturally grotesque in this setting that it is truly beautiful. A natural waterfall has been damned for bathing and all sorts of little walk ways have been constructed of stone and cement on both sides of the road, leading down toward the water. With no one around to ask permission, we picniced in a covered pavillion with table, cement ledge for seats and a small faucet to wash our hands. Across the road was a palm thached roof over a small pavillion or landing on the way down further to the creek. The roof was on the same level as the road and was covered with blooming impatience! This unpaved road continues on up around the mountain and exits somewhat north of where we started on the main highway. If we ever locate the proper vehicle to carry our lunch and gear, we should like to walk the distance of this entire road.

Mother and I chose to walk back to the main highway in order to give me a preview of what might be found in this tropical rain forest. I had been impressed with the number of different ferns that grow in the mountains toward Maíz, but here you count in tribes, not genera. *Polyposium aureum sporadocorpum* is a grey-leafed hare's foot type that grows in the trees with orchids, *Bromelliads*, *Ripsalis* and no telling what else. The native *Heliconia* adapts beautifully to Brownsville's climate, as well as several rhizomatous *Begonias*, *Calathea*, *Pilea*, *Tradescantia*, *Philodendron* and *Monstera*. We passed over a number of different and familiar *Peperomia*, but I couldn't resist two *Selaginella* species for a terrarium. We found the same *Achimenes* species here in a sheltered spot, but it was soon to be overtaken by more lush summer growth. It was too soon for many vines to be blooming, much less to have ripe seed, but we recognized a *Thunbergia*. One vine with bright orange inflorescences with tiny flowers had us stumped. It was *Cissus cucurbitina* or something similar. We were on a very well traveled road and viewing just a few of the more ordinary exotics of a lower elevation. This mountain range around Tamazunchale is noted for a number of different Cycadaceae species and varieties. We saw one lone *Ceratozamia mexicana* growing high in a rock crevice. For a time in this giant greenhouse, rain lilies were forgotten; but they are probably up there too.

MEXICAN ZEPHYRANTHEAE IN THE ORDER OF THE TRIPS

(a) Brownsville To Ciudad Mante
(b) Cuidad Mante to Cuidad del Maiz
(c) Cuidad Mante to Tamazunchale

Z. chlorosolen (Z. herbertiana) - Common white flowered, subgenus **Cooperia**.

Z. pulchella - Found on the East Coast of Mexico. Flowers generally small and paler yellow than Texas the type.

Z. sp. Clint M-550 - Medium-small, pale yellow flowers fading to cream colored, pointed segments, roundish bright green foliage. Somewhat similar to "Valles Yellow", but not as adaptable or ever blooming. A deeper yellow flowered species grows with this, possibly the same type.

Z. sp. Clint M-292 - Star shaped, open, two-inch white flowers, elevated

tiny stigma, subgenus **Cooperia.** Size of bulbs, color of bulb tunics and flower parts appear quite similar to **Z. traubii,** although the 2n chromosome number has been found to be higher (see earlier reference). Grows in part shade on rock ledges, semi-wet mountain forest.

Z. Clintiae Complex - This term has evolved to cover the myriad of rain lilies found in and near the type locality. It is also a convenience when used to describe **Zephyranthes** found in other parts of Mexico when flowers share the same general cup-shaped appearance and certain other characteristics like small, capitate stigma. Color of flowers ranges from white to pink to dark rose-red. Heaviest bloom is from April to mid-May. Listed below are a few collections with brief non-scientific notes.

M-154-155 - Medium to dark rose, full petals, ruffled or course textured. This is one of the larger flowers produced from large bulbs with rather wide, flatish leaves. It grows with M-292 above.

M-16, 471, etc. - **Z. clintiae** as described (see earlier reference). Small, dark rose-red flowers with full wide petals, somewhat cupped or crocus-like. Leaves upright, rather narrow, channeled, with maroon at base. Dry mountains with scrub oak. 2n=48 "(**The Zephyranthes Clintiae** Complex. I. Initial Report on the Somatic Chromosomes;" Dr. Raymond O. Flagg; PLANT LIFE: 1960, pp. 86-92).

M-22 - Bright pink flowers, white in throat, good substance, opens flat.

M-25 - Same as **Z. clintiae,** only much larger and perhaps easier to maintain and bloom.

M-26 - Large open, star shaped flowers, long narrow petals.

M-72 - Tiny cup-shaped flowers, rose and white.

M-176 - Large, rose pink, robust grower under cultivation. Flowers are somewhat coarse.

M-217 - Medium sized flowers, pink with white throat and deeper pink spots around center. Easy and rather robust like M-176.

M-630 - Lovely large light pink open flowers, 6-½ cm., broad petals, white to greenish throat. Filaments distinctly two lengths, stigma deeply trifid.

M-557 - Flowers dark rose-red, large, fading to orchid. Segments long, narrow, open and somewhat floppy. Stigma narrowly trifid, long style. West bank of Cañon de Borregos. Possibly due to long drought or change in upper water shed, the roadside area here is no longer as distinct as it once was and there is no longer a bridge or culvert at the base.

Howard's White Zeph. sp. - Three inch white flowers, open, broad petals, somewhat like **Z. grandiflora.** Bulbs growing under oak trees beyond Cañon de Borregos, just east of Maiz. Similar pink flowering bulbs in colony. Difficult to maintain.

Clint M-522 - Flowers medium-large, pink with a white center. Dependable bloomers, appearing in July or earlier with heavy rains. A **Z. macrosiphon**-type close to M-30 from Tamazunchale, although this grows further north at "Rancho del Cielo".

Howard's Tiny White **Zeph.** sp. - After years of collecting bulbous plants in Mexico, Dr. Howard found this new little white **Zephyranthes** just north of Valles in May 1971 (see earlier description).

Z. sp. Steude's "Valles Pink" - Small, light pink **Zephyranthes,** found a few miles south of Valles by the river. My notes are skimpy on this one, but the river should be the El Naranjo, or branch by another name, which originates northwest of El Naranjo on Highway 80.

Howard's 53-1 "Valles Yellow" - Found about mid-way between Valles and Tamazunchale on the west side of the highway in a ditch, this yellow rain lily is important for several reasons. Its 2n chromosome number is 28 (the most common number of Mexican **Zephyranthes** studied is 48). ("Chromosome Diversity in Species, and in Hybrids, of Tribe Zephyrantheae." Dr. Walter S. Flory. The Nucleus: Seminar on Chromosome, 1968: 79-95.) This species is easily grown from seed and is a dependable repeat bloomer. Although it is a bog plant in habitat, it does not seem to be fussy under cultivation.

Howard's 53-3 "Crepe" - Small, rose-pink, with white center and keel; crepe texture. This was found in July north of Tamazunchale and is possibly related to the **Z. clintiae** complex, but from a low elevation.

Clint M-375 - This perky pink little **Zephyranthes** was found almost in the town of Tamazunchale in late summer along the banks of the Rio Moctezuma. Bulbs and flowers are small and foliage is narrow, fleshy, bright shiny green and deeply channeled. It offsets freely and blooms mid-summer into fall; appreciates light shade. M-375 is probably related to **Z. macrosiphon,** but is rather distinct in its habits.

Z. macrosiphon - Clint M-30 was found by my brother, Morris Clint, Jr., in 1947 in a creek a few miles north of Tamazunchale. It was identified as **Z. macrosiphon** by Dr. Traub. A site with more abundant numbers was later discovered south of the city, just beyond the state line of Hidalgo, The finest forms of this species are quite large, pink with a white center, and bloom on stout stems in July and August. Leaves are broad and rather flat. Leaves of the "Rancho del Cielo" **macrosiphon** are more narrow, channeled and dull green. In 1970, we found still another **macrosiphon**-type west of Valles on Highway 86, half-way to Rioverde. These flowers had lovely form, cool pink with white center, but proved difficult to bloom under cultivation. They were growing in almost pure gravel, with roots in a sandier strata.

1978 **NERINE** REPORT FROM HOLLAND

G. A. M. Zuidgeest, *Middelbroekweg 71, Honselersdijk, Holland*

Nerine sarniensis and many of the hybrids are subject to bulb rot. The rotting appears especially during the rest period from the middle of April to mid September. Moisture applied to the bulbs can be disastrous during this period.

The rot begins above the bulb-necks and in the course of time penetrates inside the bulbs, and the new growing points may be affected leading to the loss of the bulbs.

The onset of the rot is caused by the entry of dew, etc., under the dry leaf-bases at the bulb-neck. The symptoms show-up as red-brown spots, which resemble fusarium or sometimes rhizoctonia.

It is our practice to immerse all Nerine bulbs in a solution of Benlate 4% for an hour and a half. The bulbs are then planted immediately. But this procedure does not appear to be sufficient. Therefore in early spring (March) we also water the plants with a solution of Benlate 4%, and repeat this treatment in April. We hope by this treatment that the Benlate will soak through the leaf-bases at the bulb-neck and reach the inside of the bulbs.

Experience seems to indicate that *Nerine sarniensis* and the hybrids grow best in soil mixed with some old cow manure, or a similar mixture. In my opinion, the best we can do, when the bulbs are grown in pots, is to fill the lower half with peat litter and the upper half with coarse granular sand. If the sand is too fine, there is the chance that the soil will be compacted and become green with algae which restricts growth.

During the rest period when grown in pots, we place the pots in saucers with water overnight, thus allowing the roots to take up moisture.

Many of the Nerine clones start root growth during the middle of

July. Water them overnight to give them a strong start. It is good practice to repeat this once in August and September. In October growth is advanced far enough so that water from outside does not encourage bulb-neck rot. With the windy weather, we give most water in November, December and January.

GROWING AMARYLLIDS IN THE MIDWEST

JAMES E. SHIELDS, *7229 Wynter Way, Indianapolis, IN 46250*

In addition to the *Hymenocallis* discussed previously (Shields, 1977), several other genera of the Amaryllidaceae have been grown for the last few years.

A species which finds a multitude of uses is *Habranthus robustus.* This little plant, which offsets profusely, blooms in the shaded bed as a border in front of the *Fuchsia, Impatiens, Achimines,* and *Begonia* hybrids. It also flourishes in full sun as a border for the bed of summer bulbs. The one place it does not bloom well is in the greenhouse in pots. It is, of course, not hardy, and the bulbs are lifted each autumn for storage. The little Texas Copper Lily, *Habranthus texanus* (properly *H. tubispathus*) does grow and bloom in pots. It is apomictic when pollinated with *robustus,* yielding progeny identical to the seed parent. One desert species also has bloomed in the greenhouse: *H. concolor.* This plant gives only a single scape in any one year, but has been producing two large, healthy offsets each season. This species is very susceptible to mites, for which a satisfactory control is Plietran ® applied two or three times during the growing season. If a potted bulb of *concolor* is allowed to spend the summer out on the patio, it will survive but without vigorous growth. In our climate, *Habranthus concolor* is a greenhouse plant.

Sprekelias are attractive and reliable bulbs for spring bloom in pots or for early summer bloom directly in the outdoor beds. No problems have been encountered in obtaining bloom from *Sprekelia formosissima* f. *williamsii*, *S.* ''Orient Red'', *S.* ''Maxine'' (Howard), or the Woelfle seedlings. All may be stored bare in the heated garage at 50-60°F each winter. Leaving bulbs potted year-round has not been attempted. Several hybridizations have been tried, but none of the seedlings have yet reached blooming size. Eagerly awaited are young bulbs of ''Orient Red'' x *williamsii* and ''Orient Red'' x ''Maxine''. Closest to blooming size are a pair of seedlings from a cross of (''Aztec Idol'' x ''Superba'') x (''Inca Queen'' x ''Orient Red''). The pod parent is a Woelfle seedling, and the pollen parent is a Clint hybrid seedling; both parents were received from Dr. Thad Howard.

Two varieties of *Crinum* provide attention-getting specimen plants in large tubs every summer: *C.* ''Ellen Bosanquet'' and *C.* ''Cecil Houdyshel'' are both beautiful and reliable. The tub of ''Cecil Houdyshel'' blooms several scapes in June and July, followed by ''Ellen Bosanquet'' with two scapes in succession in August and September. Stored in the garage during the winter, neither variety goes completely

dormant. At one time, a plant obtained from the same commercial source as the "Cecil Houdyshel" but labelled "kirkii" bloomed in precise synchronization with "Cecil Houdyshel" several times in succession. Moreover, the flowers seemed indistinguishable to this writer. The foliage of "Cecil Houdyshel" may be slightly wider than that of the "kirkii", as judged by the two aforementioned plants. Nevertheless, some doubt remains as to the true identity of the plant referred to here as "Cecil Houdyshel". *Crinum moorei* has yet to bloom after many years. It produces abundant offsets, and has pushed itself out of a series of ever larger pots, by its vigorous root growth. Still no blooms appear. *Crinum submersum* blooms in some years, always with only a single scape in any one season. My ambition to cross *moorei* and *submersum* seems to be doomed to permanent frustration. Another stubborn non-bloomer has been *C. zeylanicum*. Any sensible gardner would have long ago consigned it and *moorei* to the compost pile.

INSECT PESTS

Mealy bugs have been a much more troublesome problem than mites in recent years. The Lily Mealy Bug, *Chorizococcus lounsburyi* (Brian) an insect of the order HEMIPTERA, has been identified as the culprit by Mr. Virgil Knapp, of the Indiana State Entomologist's office, with confirmation from the USDA in Washington. This, according to Mr. Knapp, is a new state record for this pest. The insect has been found on bulbs brought into winter storage after growing out in the garden for the summer, and also on greenhouse plants. Its skin is protected by a waxy exhudate, so that very strong detergent concentrations are required if aqueous sprays or dips are to be effective. Furthermore, most organophosphate insecticides, such as malathion, Cygon-2E ®, and diazinon, are toxic to many plants in the Amaryllidaceae. Some control has been obtained using chlordane 50WP as a dusting powder, but this does not give total eradication; nor can it be recommended for this, as this is not an approved use for chlordane. Zectran EC is still available in garden stores and is a strong insecticide of the carbamate family. It is currently being tried by the writer for control of the Lily Mealy Bug, using 2 Tbsp. per gal. with generous addition of spreader-sticker. The bulbs are soaked in the solution for one-half hour or longer, then dried in air for 2 days before being put into winter storage.

PANCRATIUM FOR WINTER-RAINFALL GARDENS

RICHARD E. TISCH, *20516 Clark St., Woodland Hills, Calif. 91367*

In the Los Angeles area of Southern California we can expect no significant rainfall from May 15 to October 15. Up until recent drought-affected years we have lavishly poured water from hoses and sprinklers onto our lawns and gardens. Now, however, we are looking more favorably toward those plants which can survive, even flourish with

little or no watering during our dry season.

Traub discussed this briefly in 1961 in Plant Life,[1] mentioning *Brunsvigia* and *Nerine* and suggesting that there are others which prefer the dry cycle during the summer months. One such is *Pancratium*, with possibly some care necessary in selecting the species to grow. I have seen several types flowering in local gardens, apparently without constant watering. In particular, one clump has held my interest for over 20 years.

Fig. 22. **Pancratium maritimum** as grown by Richard E. Tisch in southern California.

Growing up against a chain link fence facing the street in front of a home that was built in the 1940's, it has sent up its *Narcissus*-like glaucous leaves every winter, and many scapes of pure white flowers every July-August. Shaded from the morning and noonday sunlight by Pepper Trees, it withstands the glaring afternoon and early evening sunlight during our long hot summers here in the San Fernando Valley. In the winter, during our on-again, off-again rains which rise to downpours, the umbrella covering of the trees prevents it from receiving direct soakings.

When the owners moved from the house five years ago, digging some

bulbs from around the edge of the clump was tried. From the rock-hard adobe only a few bulbs were finally extracted. One flowered the following summer in a border alongside a lawn; another sent up some leaves in the winter but apparently rotted from too much daily watering during the sumer. The second year, the first bulb clump apparently died, probably for the same reason.

The following August, several scapes with seed pods were gathered from the clump. They were placed in shade in a pitcher half filled with a nutrient solution, *plus colchicine*. A month later 119 large triangular cross-section, pear-shaped seeds were planted in a plastic dishpan in a standard potting compound, loose and well drained, with exploded mica on top. Most of the seeds germinated, but many were albino; the latter died, leaving only 34 seedings for transplanting outdoors.

Of the 34 set out in a bed with a sunny exposure, in loose, fast-draining soil, 23 survive today. One is noticeably much larger than the balance. For two years I was at home and able to restrict the amount of water given to the plants during the summer months. Then my work took me away frequently, and the youngsters charged with watering our plants made sure that every plant in the yard was regularly soaked, and some of the plants dwindled and disappeared. This summer, four years after sowing, three plants have flowered and the fourth, the largest, is sending up an oversized scape. The flowers, when put in a small bud vase in the house, produced a fragrance that created an arresting aura for several feet, with a sweetness that hung in the air for hours.

With the added suggestion that they perhaps would flourish even better if grown in a location which provides shade during part of the day, I unconditionally nominate such a plant for your Winter-Rainfall Garden, and will glady send a few bulbs to anyone wishing to try growing them in this fashion.

LITERATURE CITED

1. Traub, H. P. 1961. Winter-Rainfall Garden in Southern California. PLANT LIFE 17: 113-114.

(See also article by V. Roger Fesmire in the present issue of PLANT LIFE.—H. P. Traub).

1978 ALSTROEMERIA COMMITTEE REPORT

DONALD D. DUNCAN, *Chairman, Alstroemeria Committee, P. O. Box 238, Sumner, Washington 98380*

This past year was the first time that cut Dutch Hybrid *Alstroemeria* have appeared in the Seattle wholesale florist markets. I believe these are of the Regina Hybrids. They have long straight stems and the flowers come in near white, creamy yellow, yellow, orchid and pink.

I have tried to find the names of the growers in California who are producing these, but as yet I have been unsuccessful. I would like to correspond with them or visit their operation and report on it next

year. Perhaps someone reading this can supply me with the information I need.

Professor Harold Wilkins of the University of Minnesota at St. Paul and his graduate student assistant, Royal Heins, have been doing research on the commercial growing of *Alstromeria*. They too are working with Regina Hybrids which were produced in the Netherlands.

As pointed out in their articles that have been published in the FLORIST REVIEW MAGAZINE, these *Alstroemeria* grow best at a temperature between 50 to 55 degrees Fahrenheit (10 to 12.5 degrees C.). They appear to have two blooming cycles per year. The spring production begins in March and peaks in May. The plants stop flowering in June and then produce a second crop from September to December. I am sure we can look forward to much more cultural information on the greenhouse production of *Alstroemeria* from Professor Wilkins and his assistant in the future.

I also wish to make note of the surprize visit paid me this last summer by Gerard Zuidgeest, the foremost hybridizer of Nerines in Holland, and by Hans Rood, a Dutch importer of exotic seed.

It was one of those damp, grey, rainy evenings for which the Seattle area is famous, that these gentleman arrived at the greenhouse to see my *Alstroemeria* collection. I am afraid that they expected to find a growers range of greenhouses. I am not a commercial grower. I have one greenhouse only, devoted more or less to *Alstroemeria*. However, they did show interest in my collection.

We then retired to the shelter and warmth of my home to view Mr. Zuidgeest's color slides of his beautiful Nerines. Besides his breeding program, which has obviously produced many wonderful colors, Mr. Zuidgeest is working on perfecting the forcing of Nerines so that they could be brought into flower on a planned schedule, thus producing cut flowers all year long. It is hoped that he can be persuaded to write an article for a future issue of PLANT LIFE.

AMARYLLIDS ON A DRY HILLSIDE *

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In the late summer of 1972 we moved from Torrance to Perris, going from a rather cool coastal climate near Los Angeles to one of the hot interior valleys of southern California. In the moving we took along all those bulbs that we thought might grow in a semi-desert climate, where the temperature reached 110° F. in summer and dropped to about 24° F. in winter, with very little rainfall. As might be expected, some bulbs did not survive long, some grew but never bloomed, while some really thrived and gave us some very welcome suprises.

Arriving in Perris, a garden was soon laid out on a steep, rocky

* See Article, page 101, PLANT LIFE 1971, for last of previous contributions.

hillside, spotted with huge boulders. Near the base of the hillside, within a semi-circle of these huge boulders, the bulb garden was established, and here most of the bulbs were planted, although a few were left in large pots on the patio at the rear of the house.

AMARYLLIS AMBIGUA

One of the bulbs that really thrived was *Amaryllis ambigua*, a long trumpet species with pink and white flowers. This had been received from Dr. Ruppel of Argentina in 1967 as a very large bulb, but grown in a pot at Torrance, it never bloomed, and grew so poorly that the bulb became smaller every year. Here at Perris, it apparently found a climate that suited it, for it began to grow vigorously, sending up many large leaves both spring and fall, and blooming with two scapes every summer. When we moved back to the Coast in December of 1976, this bulb was again put into a pot and taken along. It sent up a flower bud in the spring of 1977 and another one in the fall, but both failed to make it through the neck of the bulb. Neither did it grow any new leaves until the fall months; so I have doubts that it will ever bloom again. The lesson from this experience is obvious.

AMARYLLIS AULICA

Three varieties of *Amaryllis aulica* were planted in the bulb garden: one variety known as "Robustum", another one bought many years ago from Van Tubergen in Holland, and the variety *Stenopetalum*. This latter gradually vanished and was lost, the variety from Van Tubergen grew but did not bloom (although it had bloomed infrequently grown in a pot), but the variety known as "Robustum" not only grew but flourished, blooming faithfully every spring. It might be noted that this bulb has such wide leaves that it just might be a hybrid of *A. aulica* rather than a variety of the species, although it rests in summer and sends up leaves in the fall.

AMARYLLIS

Amaryllis papilio grew very well, but the foliage was considerably smaller than when grown nearer the Coast, and it never bloomed at Perris. It also lost most of its leaves during the winter months. Planted in a large pot again when we moved back to the Coast in December of 1976, it gradually went completely dormant, and did not begin to grown again until the fall months. Perhaps now it will decide to bloom. A hybrid of *A. papilio,* received from a friend in Passadena in 1975 as a mature bulb with offsets, was kept in a large pot on the patio. This grew fine and bloomed with dull brownish red flowers twice a year at Perris, but isn't doing so well since moving back to the Coast. Some small and medium-sized bulbs of the large-flowered *Amaryllis* hybrids were also planted in the ground at Perris, but all were failures.

OTHER AMARYLLIDS

The majority of the bulbs planted were other memmbers of the

Amaryllis family, many of which are more suited to a hot, dry climate than the genus Amaryllis. All of the Brunsvigias did very well, a large white-flowered variety being especially beautiful A *Zephyranthes* with white and yellow flowers grew to perfection at the base of a large rock. During one blooming spurt we counted close to fifty flowers in bloom on one small clump. I should have tried other varieties of the Rain Lilies, as probably all would have flourished here. A white flowered *Narcissus* was also very free-flowering in full sunshine.

Some bulbs grew satisfactorily, but the foliage did not like the intense sunshine and perhaps they were not watered enough, bulbs such as *Tulbaghia fragrans, Paramongaia,* a dwarf *Hemerocallis,* and *Agapanthus.* The dwarf *Agapanthus* hybrid "Peter Pan" was planted in full sun further up the hillside, and while it bloomed very well, the leaves became smaller each year. When a piece of it was put into a large pot and kept on the patio in partial shade, it at once more than doubled in size, but did not bloom quite as profusely. The regular variety of Agapanthus did very well when grown on the north side of the house.

Four species of *Lycoris* were planted: *albiflora, radiata, squamigera,* and *aurea.* The last named vanished at once, *L. squamigera* struggled through one year and then gave up (although it grew well in Colorado), *L. radiata* grew and multipled but never bloomed, while *L. albiflora* both grew well and bloomed nicely; its white flowers tinged a pale yellow were a decided asset to the bulb garden. One of the biggest surprises came from a flower somewhat simimlar in appearance to *Lycoris albiflora,* namely a bulb labeled *Pancratium maritimum.* This bulb had been grown for many years in a pot, but I don't recall it ever blooming before. Here in the ground on a well-drained steep hillside, it grew luxuriantly and bloomed for a long period every summer, the leaves remaining evergreen all the year. (See also article by Richard E. Tisch in the present issue of PLANT LIFE.—H.P.T.) Back into a pot again when we returned to the Coast, it reverted to former habits. Again, the lesson is obvious.

Most of the *Hymenocallis* species, and all of the Crinums, were left behind in Torrance when we moved to Perris, as I did not think their foliage would take the sunshine and heat. However, *Hymenocallis littoralis,* was brought along and planted in a narrow space between two tall boulders, where it was shaded much of the day and probably had access to more soil moisture. At first it did not do too well, but finally after three years, it suddenly begain to grow luxuriantly and sent up three or four huge flower scapes with very large white spider flowers; it was magnificent! This species had been my smallest one when grown in a pot, and that is why it was brought along, but here it evidently found a location that suited it perfectly. To grow these exotic plants from around the world, it is obvious that one must attempt to approximate their native habitat, or expect nothing but failures.

Many other plants were also grown successfully, such as *Nerine bowdenii* in the ground and *Alstroemeria pulchella* (the Brazilian Parrot

Lily) in a large pot on the patio, but the highlight of the winter blooming season was a hybrid Nerine with vivid "pink" flowers. During the Christmas season it furnished a brilliant spot of color in the garden, and it is just as good when grown in a large pot. It is evergreen and flowers easily and abundantly and is a more compact plant than *Nerine bowdenii*. If I could have only one Amaryllid, this one would be my choice. Needless to add, it will always move with me, for it is not fussy about its environment, and is now growing fine in a pot on our patio only two blocks from the Pacific Ocean.

LEAFHOPPERS ON AMARYLLIDS

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This past summer was marked by an invasion by a species of lateral moving leafhopper. These small (0.3″), speckled insects are normally found on the underside of leaves. The species seen in this locale had a remarkable ability to avoid capture, and observation by moving laterally around a leaf, out of view. I should not refer to them in the past tense, since they are still around.

Leafhoppers are characterized by needle-like mouth parts which suck the juices of plants. They are carriers of virus diseases from plant to plant. As they feed, they exude "honeydew", a sweet, surplus sap that attracts ants, and bees. These factors did not present the real difficulty, however.

Female leafhoppers lay eggs in stems and leaves. This is where the real damage is done. A bubble-like streak can be noticed on the underside of the leaf. The eggs are contained within. The egg deposits should be gently scraped from the leaf when first noticed. These deposits were noticed on such amaryllids as *Clivia nobilis*, *Haemanthus puniceus*, and *Hymenocallis speciosa*. However, the plant most severely affected was *Neomarica gracilis* (Iridaceae). On the latter plant, the egg cases would frequently penetrate both sides of the thin leaves. In the thicker leaved amaryllids, only the outer surface of the leaf was generally affected. Deposits on the amaryllids were few as compared to the *Neomarica*.

Favorite host plants of the leafhoppers were species of *Yucca*, *Cordyline*, and *Agave* (all members of the Agavaceae). Large colonies would form on these plants, and the presence of honeydew was obvious. Egg cases were seen on the under side of the leaves. Damage to these plants was not significant.

Insecticides recommended for leafhoppers are *Malathion*, *Diazinon*, and *Parathion*, among others. The problem is that the damage (egg cases in the case of amaryllids) has already been done by the time the insecticide is applied. New egg cases appeared over night. Insecticides were not used on the host plants.

Adults hibernate and emerge in the spring in certain areas. They

Bennett—LEAFHOPPERS ON AMARYLLIS, continued on page 59.

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POLIANTHES HYBRIDS

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Last year I was pleased to announce that a new form of *Polianthes* x *Blissii* had been duplicated by Luther A. Bundrant of Poteet, Texas. The experiment was made to combine both color and fragrance in hybrids with characteristics of the tuberose. This year I am again pleased to announce another new hybrid, *P.* x *Bundrantii* (*P. tuberosa* x *P. howardii*) which is similar to tuberose, save that the flowers have maroon interiors and rose-pink exteriors tipped green (Fig. 23). The fragrance is there, particularly at night, but it is subtle. We knew it would be a longshot to obtain fragrance in a highly colored polychromatic plant like *P. howardii* with its blackish interior and green-red-yellow exterior. One automatically does not expect fragrance to be combined with such a mosaic of gaudy colors. It is to the tuberose's credit that its powerful fragrance can still exist even in its highly colored hybrid offspring.

Polianthes howardii Verhoek-Williams is a new species, discovered in 1972 and published in 1977. It is endemic to a small mountain range in the state of Colima, Mexico. It has had instant success as a garden plant by the few who have seen it and grown it. The flowers are a gaudy combination of green-tipped tubes with a red and yellow exterior and a maroon-black interior. They are scentless, but they may have up to 50 flowers on 3-4 foot stems, and they last well. Unlike most other *Polianthes* which have the flowers in pairs along the stem, those of *P. howardii* are produced singley at each node. One might think that *P. howardii* would be difficult to improve upon, but that is exactly what Mr. Bundrant has attempted to do when he crossed it with *P. tuberosa.* The new hybrids, I have named the hybrid, *P.* x *bundrantii*, in honor of its originator. The flowers resemble the tuberoses in form, pairing at the nodes, but have milder fragrance. They have a maroon interior and green-tipped pinkish exterior like the other parent. It is self fertile, just like its relative *P. x blissii*-Worsley. The next step is to see if the two new hybrids will cross with one another in order to recombine the genes for color with the tuberose genes.

Other *P. tuberosa* x *Polianthes* species seedlings are in the offing. There are two new *Polianthes* species, each with an orange red exterior and yellow interior, and Mr. Bundrant now has what we hope to be hybrids with these and *P. tuberosa.* In addition, a pinkish-white fragrant species from Jalisco has been crossed with *P. tuberosa*, and prospects here seem to be good too.

Mrs. Susan Verhoek has experimentally crossed *P. tuberosa* with *Manfred virginica* and obtained tuberose-like plants with some of the spotting of the *Manfreda* parent in the foliage. Flowers were fragrant (both parents are fragrant) and greenish, like *Manfreda.* Since *M. virginica* is hardy in the lower half of the USA, presumeably these "Manfredanthes" hybrids are at least partly hardy. I have no idea

if they are self fertile, but if they should be, then there is reason to hope that they might intercross with Mr. Bundrants hybrids. Most flowers in the genus *Manfreda* are greenish or brownish, but at least two species have pinkish flowers. Some *Manfreda* species are fragrant, some are odordess, and a few have a medicinal odor. The Manfredas of the south-

Fig. 23. **Polianthes** x **bundrantii** T. M. Howard, **hybr. nov.**

eastern United States and Texas are at least partly hardy to Oklahoma, Tennessee and Virginia. Both *M. longiflora* (syn. *Runyonia longiflora*) of South Texas and Northern Mexico, and *M. maculosa* of south Texas, are both colorful (pinkish flowers) and delightfully fragrant. *M. virginica,* though not colorful, is delightfully fragrant. *M. brunnea* of Chihuahua in Mexico, is likewise fragrant. *M. potosina* from San Luis

Potosi, Mexico is like a miniature form of *M. virginica.* All of these might be useful in crosses with *Polianthes.* There are many other Mexican *Manfreda* species that might likewise be of interest in a breeding program. We prefer these that are showy, hardy, and fragrant. *M. variegata,* from the lower Rio Grande borders of Texas likewise is of interest, though the flowers have a medicinal odor, like some old cough syrups.

In closing, the writer might mention the existence of self-fertile tuberose clones. I had never noticed it before until the last ten years or so. Then I began to be aware that my tuberoses, obtained locally, were setting seed with some frequency. Eventually I saved seed and gave it to Luther Bundrant to grow to maturity, which he did this year. Ordinarily seed-setting is no phenomenon, but with tuberose, it seems to be. They have been in cultivation for over 400 years. No wild plants are known or have been found by modern man. The origin is said to be Mexico, but this has never been proved, though all the other *Polianthes* species have been found there. It is possible that *P. tuberosa,* like wild corn, simply does not exist in the wilds any longer. The highly civilized Indians of Mexico and Central American Aztecs, Mayans, etc., undoubtedly had use for cut flowers in their markets, just as they do today, and tuberoses no doubt played an important part in this. The Aztec hierarchy loved flowers as well as anyone, and used them in their festivities. No doubt Indian women gathered tuberose bulbs and grew them with other ornamentals alongside their corn fields. If *P. tuberosa* was as endemic as other *Polianthes* species, it would not take long for them to disappear as a wild flower, but as they are so easy to cultivate, it was only natural that they remain as garden plants. Aside from our new F-1 seedlings, only 2 or 3 tuberose clones are currently being cultivated here—a single flowering one and a double flowering one. A single flowered variegated-leaf clone has been offered in the past, but I have not seen it listed in a couple of decades.

POLIANTHES X BUNDRANTII T. M. HOWARD, **SP. NOV.** Fig. 23

Planta hybrida P. tuberosam ♀ et *P.* howardii ♂ intermedia, inflorescentia hanc *P.* tuberosae simulanti, flore intus marronina apicem versus viridi extus subrosea differt. Typus: TRA No. 1173, Aug. 15, cult. San Antonio, Texas.

Description.—*P. tuberosa* L. ♀ x *P. howardii* Verhoek-Williams ♂.

Bulb: oblong, 8 cm long and 3.2 wide. lt. brown outer coats darker near base with fleshy roots; *Lvs.:* 12 in number in rosette, linear, 1.5-2 cm wide, 41-55 cm long, channeled, acute, margins entire, slightly succulent. Meadow-green, undersides dotted maroon on lower $\frac{1}{4}$-$\frac{1}{2}$ length. *Stem* lvs become progressively smaller as they ascend; *Scape:* a raceme, 14.3 dm. tall, meadow green with upper part glaucous; stem base 8 mm diameter.

Floral bracts: one per node, lowest 3.7 cm long becoming smaller as they ascend. Lower bracts meadow green, upper bract lighter in color. *Flowers:* 53 in number, normally paired, but sometime lowest

flowers may be single, sometimes quadrupled in lowest 2-4 nodes, paired thereafter, tubular, flared at tips, slightly fragrant, especially after sunset.

Pedicles: 3 mm to 2.8 cm, longest at lower part of stem; Ovary: 0.9 cm long 3 mm wide, meadow green; *Tepaltube:* slightly curved, tilted 45° above horizontal, 3 cm long, 3 mm wide, at base widening to 8 mm at top, outer surface colored rose-pink, inner surface ivory; *Flower face* 1.7 cm wide, outer three segs 1 cm long, inner three segs 0.8 cm long, 4-5 cm wide. Outer three segs pale green on exterior surface, inner three segs pale green with pink stippling on exterior surface. Inner surfaces of segs ivory, heavily stippled maroon, with ivory keels and margins. *Anthers* cluster at upper surface of tube just below base of segs. *Filaments* 1.1 cm long, attached to tube 1.2 cm above ovary. Style white with maroon stippling near stigma. *Stigma* tri-lobed at maturity and extending beyond tube. Fls. are radially set about the stem with up to 53 fls at maturity. *Fruit:* an oblong capsule, 1.3 cm wide and 1.9 cm long, plus a beak of 5 mm long, Green, becoming lighter at maturity.

Notes: (by Luther Bundrant). In August and September of 1974, the pollen of *P. howardii* was applied to flowers of *P. tuberosa*. Four pods matured, yielding 89 seeds. These were planted in May the follow-year. They began germinating in 9 days and by the 13th day half of them had germinated. The following November, 43 seedlings were growing year. They began germinating in 9 days and by the 13th day half of sand peat moss, and oak leaf mold. These grew vigorously until water was with-held in November to force dormancy. Seven plants refused to go dormant and retained their leaves in spite of dry conditions. When weather began to warm in February, 1977, one of the seven began putting up a scape. Water was applied in late February to stimulate growth.

These first flowers in early March were disappointing, though of interest. The scape had pushed forward from a dry bulb, much too early (and too cold) in the season when temperatures ranged from 40-60 degrees F. This first effort was a bit stunted, much too pale in color, with the flowers smaller than normal. Later flowering efforts from these seedlings reassured us that we had an exciting new hybrid cross. There are some minor variations from one clone to the other, but the clone chosen to represent the cross and discribed here is typical and very representative of the clones that have flowered so far.

It is interesting to note that this cross is the second cross involving *P. tuberosa* with another member of the colored polianthes that the breeder has made and that both hybrid crosses are self fertile. (The first was a repeat of *P. blissii* in PLANT LIFE 1977). Also of interest is that the new hybrid here described is the first recorded hybrid with *P. tuberesa* as the seed parent, and may be the first documentation of *P. tuberosa* having produced seed.

NEW PLANT AND MYCOLOGICAL (MYCOTAE) TAXA

Phylum *Euglenmycota* Traub, *nom. nov.*, Subkingdom Mycotae, Plant Life *33:* 92. 1977 Syn.—Phylum *Euglenophyta*, Subkingdom *Plantae*, Plant Life *33:* 92, 1977.

Phylum *Hydrotophyta* Traub, *phylum (division) nov.*, Subkingdom *Plantae* (Plant Life *33:* 92.1977, *anglise*).

Phylum in Regno Eucaryotae Subregno Plantae Saprolegniales Albugoque Peronosporaceaeque comprehendis, plantis parietibus cellularum celloiosis, sporas flagellatas vel biflagellatas productis, et via lysina acida a-E-diamiinopimelica (DAP) exhibitentis. Typus: Order: *Saprolegniales.*

Phylum *Hydrotophyta* (Gr. *hydor,* water, *-otos,* mold-like, *-phyticos,* plants). Water Mold-like Plants. *Achlya bisexualis, Sapromyces elongatus, Sirolpidium zoophthorum, Phythium, ultimum, Hydrochytrium catenoides, Saprolegniales, Leptomitales, Peronosporales* and *Hyphochytriales,* have been transferred to Subkingdom *Plantae* with the DAP lysine path.—*Hamilton P. Traub*

STUDIES IN THE ALLIEAE II

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ABSTRACT

New South American species, namely **Tristagma peregrinans, Nothoscordum boliviense, N. capivarinum, N. exile, N. goianum, Gilliesia curicana,** and **Speea triloba,** are described **Allium subbiflorum** Bert. et Colla is transferred to **Tristagma.** A study of living material of **Steinmannia graminifolia** Phil., from the type-locality, disclosed that actually the species fits in **Tristagma.** The chromosome number for **Tristagma graninifolia** (Phil.) Rav. is reported as 2n = 8. The **Nothoscordum** species are grouped into four subgenera, to wit, **Monanthoscordum,** Rav., **Enoscordum** Rav., **Nothoscordum,** and **Platyscordum** Rav. Additionally, three subspecies are recognized within the **N. inodorum** complex: ssp. **inodorum,** ssp. **angustius** Rav., and ssp. **nocturnum** Rav. Studies in the Tribe **Gilliesieae:** The genus **Chrysocoryne** Zoella., recently described, is revealed as a synonym of **Leucocoryne** Lindl. In connection with this appraisal, **Stemmatium** Phil., is reduced to a subgenus of **Leucocoryne.** The last revisional note refers to the impossisbility of maintaining the genera **Gethyum** Phil. and **Ancrumia** Harv., as distinct from **Solaria** Phil. Consequently, **Gethyum atropurpureum** Phil., and **Ancrumia cuspidata** Harv., are transferred to the latter genus.

I. NOTES ON TRISTAGMA

1. A NEW **TRISTAGMA** SPECIES FROM URUGUAY

During explorations in north Uruguay in search of *Amaryllis canterae*, a new *Tristagma* species was discovered. This was found near

* Part I of this series appeared in Mus. Nac. Hist. Nat., Notic. Mens. 200: 3-5, Santiago (Chile) 1973; and was translated into English in PLANT LIFE 31: 52-55 1975.

the top of a branch of the Cuchilla Negra, about 8 km W-NW of Tranqueras.

Tristagma peregrinans Rav., **sp. nov.** Fig. 24

A *T. uniflorum* affinis sed habitu graciliore bulbo stolonifero folia angustiora retro-circinata recedit.

Planta usque 9-11 cm alta. Bulbus anguste ovatus extus tunicis cinereo-ochraceis vestitus ad 9-11 cm longus circ. 4-5 mm latus a caudice basali latiusculo stolones albicantes bracteatos emitens. Folia saepe quattuor linearia erecto-patentia deinde retro-circinata vel late spiralata ad 6-9 cm longa circ. 2-2.8 mm lata cinereo-viridia. Scapus debilis ad 6-7 cm longus circ. 1.2 mm latus. Spatha complanata univalvata ad apicem breviter bifida albida vel purpurescens ad 15 mm longa. Inflorescentia uniflora. Pedicellus spathae exsertus ad 19 mm longus. Flos pulchre coeruleus ad 8-9 mm longus circ. 20-24 mm latus. Tepala in tubo circ. 8-8.8 mm connata deinde patentissima lanceolata extus stria fusco-ochracea notata, exteriora circ. 3.5-3.8 mm longa acuta, interiora subaequalia. Filamenta lineari subulata in facie interiori tubi inserta, petalina sepalinum subaequilonga necnon valde supra sepalinos in tubo tepalorum affixa. Antherae subaellypticae circ. 1.1-1.3 mm longae luteae. Ovarium obovatum. Stylus filiformis albus circ. 6-6.5 mm longus a tubo tepalorum breviter exsertus. Stigma capitatus

Plant up to 10-11 cm high. *Bulb* narrowly ovate, 10-11 mm long, 4-5 mm wide, the outer tunics ashy-brown, the basal plate producing whitish, bracteate stolons. *Leaves* often four, linear, at first ascending then recurved or widely spiralled, ash-green, up to 6-9 cm long, 2-2.8 mm broad. *Scape* weak, up to 6-7 cm long, 1.2 mm broad. *Spathe* compressed, univalved, shortly bifid at the apex, up to 15 mm long. *Inflorescence* one-flowered. *Pedicel* exserted, 19 mm long. *Flower* cobalt-blue, 8-9 mm long, 20-24 mm in diam. *Tepals* joined in a tube for 8-8.8 mm, then spreading, lanceolate, with a purplish-brown streak on the outer face, the outer 12-13 mm long, 3.5-3.8 mm broad, the inner subequal. *Filaments* linear subulate, attached to the inner surface of the tube, the epipetal as long as the episepal, but inserted at a different level above the episepal series. *Anthers* subelliptical, 1.1-1.3 mm long, yellow. *Ovary* subovoid. *Style* filiform, 6-6.5 mm long, shortly exserted from the tepaltube. *Stigma* capitate.

Habitat.—Upper slopes of a branch of the Cuchilla Negra, 8 km W-NW of Tranqueras, in north Uruguay. The plants were growing among stones in a dark soil, near *Cypella Herbertii* (Lindl.) Herb. ssp. (Irid.) .

Specimens: In decliviis superioribus bifurcatio australi Cuchilla-Negrae 8 km ad occidentem vel septentrioni-occidentem Tranqueras Uruguariae; leg. Ravenna 541, VIII-1966 (typus in Herb. Ravennae.

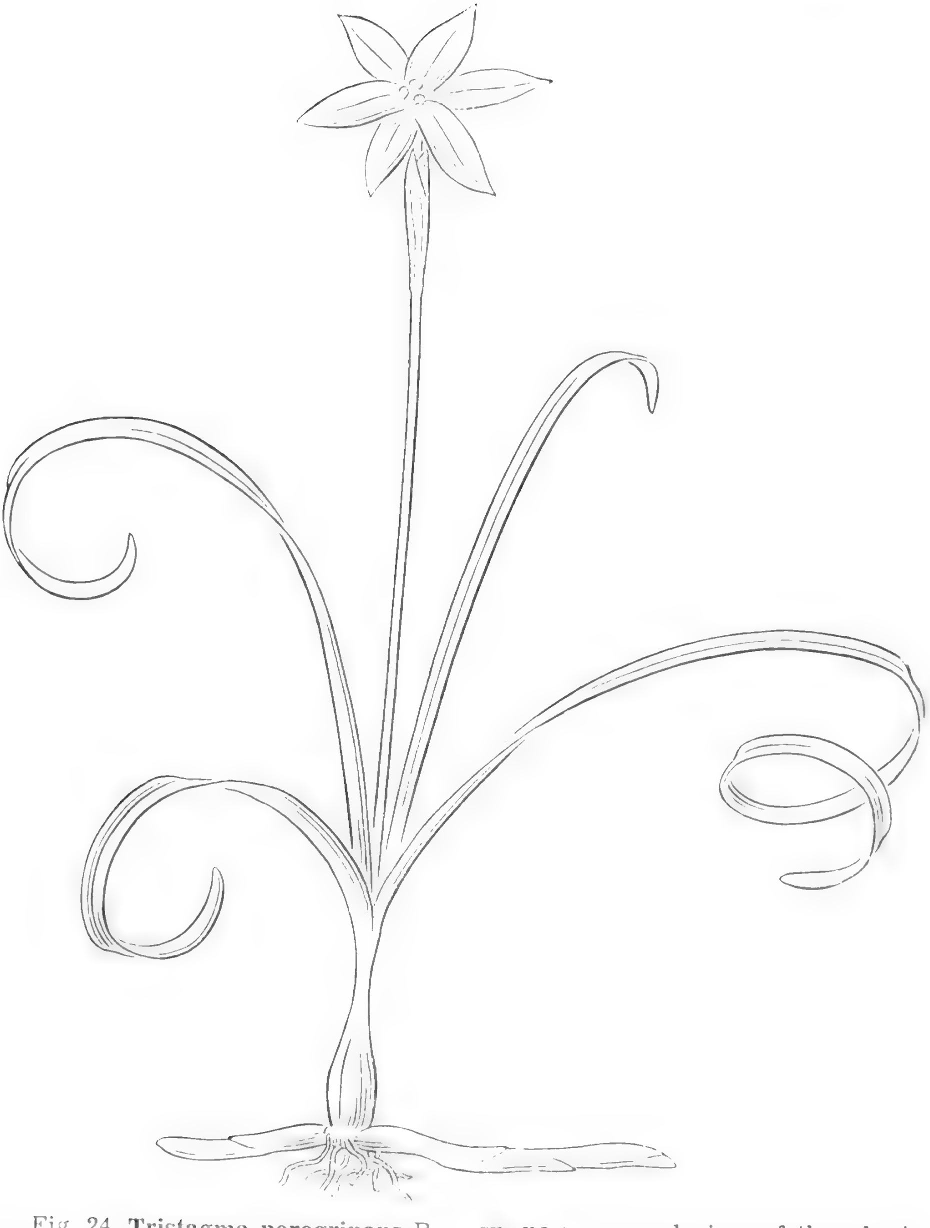

Fig. 24. **Tristagma peregrinans** Rav. **sp. nov.**, general view of the plant. Ravenna del. Flower cobalt blue.

isotypi institutionibus patet).

T. peregrinans is remarkable in being the only species of the genus that produces stolons from the basal plate. This feature is also found, as unusual, in a form of *Nothoscordum bonariense*.

The species is allied to *T. uniflorum*, differing in the mentioned character, the more slender, recurved, or backward spiralled leaves, and smaller flowers.

2. **STEINMANNIA GRAMINIFOLIA** PHIL. REFERRED TO GENUS **TRISTAGMA**

Tristagma graminifolium (Phil.) **comb. nov.** Fig. 25

Steinmannia graminifolia Philippi, Anal. Univ. Chile 65: 64, 1884.- *Garaventa graminifolia* (Phil.) Looser, Rev. Chil. Hist. Nat. (1944): 77, 1945.- *Nothoscordum graminifolium* (Phil.) Traub, Pl. Life 24: 49, 1968.

Since a number of years, I have examined in its wild state the species known as *Steinmannia graminifolia* Phil., or *Garaventia graminifolia* (Phil.) Loos. (the former genus-name was illegitimate). Experimental culture was attempted, but plants were lost after one or two seasons.

The arrangement of leaves, and the flower characters, including the perigone shape, fit in *Tristagma*. Although smaller in all its parts, the plant rather resembles *T. brevipes*, an Andean species which also has a tubular perigone.

Root-tips were pretreated, and squashed by means of the usual technique described elsewhere (Ravenna 1967). The species revealed a chromosome complement of $2n = 8$. This same number I found in several Chilean species of *Tristagma*, and was reported by Del Pozo (1974) in *T. nivale*. Unfortunately, well scattered chromosomes for illustration were not obtained.

The report of $2n = 22$ chromosomes in *Brodiaea porrifolia* (= *Tristagma bivalve*) by Sáez (1965), was probably based on some misidentified material.

The peduncle of *T. graminifolia* is, when in flower, moderately well developed. However, its growth continuates from the base after the flower has faded. When the capsule is formed, the peduncle appears as deflexed, or strongly recurved, as it is in the *humifuse* fruits of several eastern *Tristagma* species. The plants grow wedged among large rocks where rich, although scarce soil is available. Hence the fruit cannot be defined as *humifuse*, since it is suspended on the deflexed peduncle; but the growing process of the latter is the same, as explained above.

Plant up to 4-8 cm high. *Bulb* ovoid, often compressed by pressure of rocks, ca. 10-13 mm long, 7-9 mm wide; outer coats whitish or seldom brownish, prolonged for 15-43 mm into a pseudo-neck. *Leaves* narrowly linear, very slightly channelled, green, rather flaccid, smooth, 4-7 at anthesis, almost always spreading or prostrate, to 30-85 mm long, 1-1.4 mm broad. *Scape* subfiliform, erect or sometimes deflexed, brownish-green, slightly striate, 25-29 mm long, strongly deflexed when in

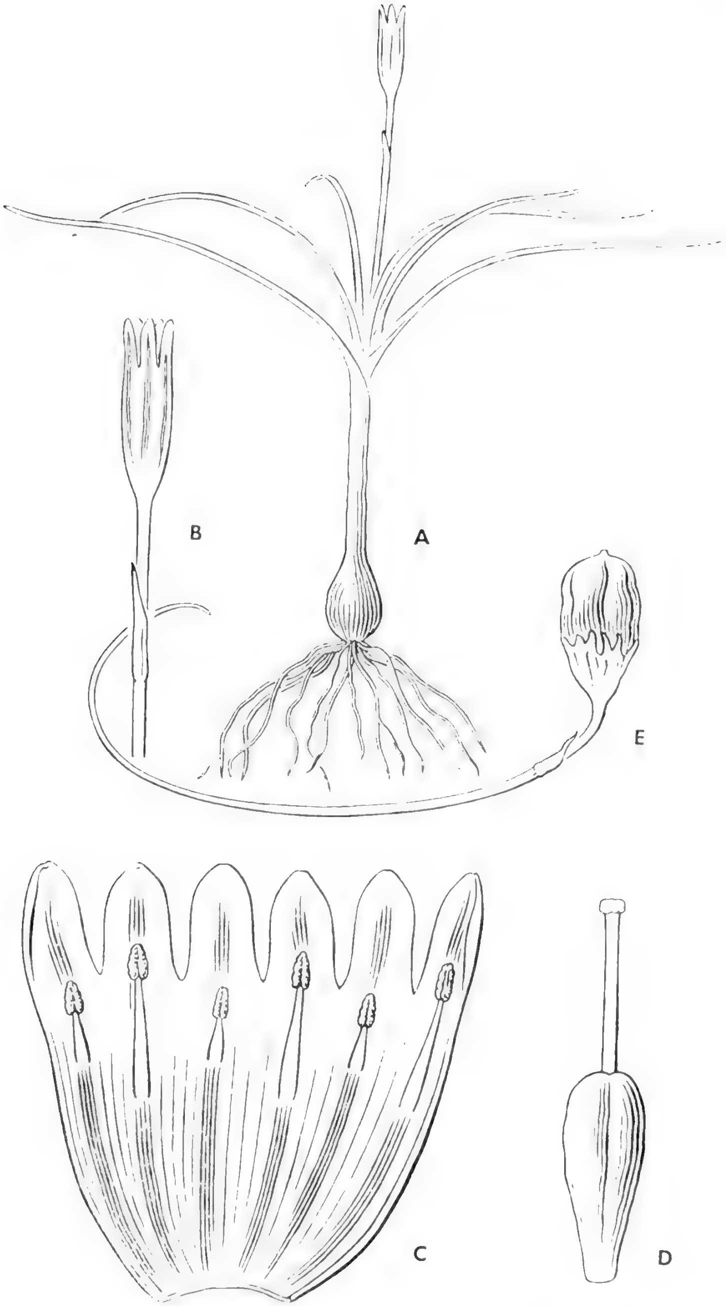

Fig. 25. **Tristagma graminifolium** (Phil.) Rav.; **A**, plant; **B**. spathe with flower; **C**, internal view of perigone showing stamens; **D**, gynoecium; **E**, aspect of scape in fruit, and capsule. P. Ravenna del.

fruit. *Spathe* one-valved or sometimes bivalved, the outer valve with its margins joined below for 2 mm, whitish-hyline, membranous, delicate, the upper part entire, 2 mm long. *Pedicel* ca. 4.8-12 mm long. *Perigone* greenish-white with six dark-purple streaks reaching the apex of segments, narrowly infundibulate to tubular, 6-6.5 mm long, 5 mm in diam. *Tepals* connate in a tube for 5.4 mm, free portion ca. 2.4-2.5 mm long, greenish inside and marked with a brownish-purple streak; the outer with an obtuse penicilled tubercle at the apex. *Filaments* linear-lanceolate or linear-attenuate, flattened; the episepal series 2.25-2.5 mm long, attached at 3-4 mm from the base of the tube; the epipetal 0.8-0.9 mm long, attached at 4.3 mm from the base of the tube. *Anthers* ovate, light yellow, erect or subversatile, 0.7 mm long. *Ovary* obpyriform green, to 3.7 mm long, 1.3 mm wide. *Style* filiform, whitish, up to 2.7 mm long. *Stigma* capitate, sometimes subtrilobed. *Capsule* almost ellipsoid, to 6 mm long, green.

Looser (1945), reports the species for the eastern slope of the Cerro de la Virgen, in the vicinity of the town of Los Andes, province of Aconcagua.

Guaglianone (1972, p. 169), states that "the pedicels incurve geothropically after the anthesis, in such manner that the capsule is pendulous, and the scape remains erect." Her appraisal, however, relied on some dry specimens at the Museum of Santiago, where the scape was pressed in an unproper position.

Specimens: Chile, prov. Santiago, Cerro Renca; leg. F. Philippi. Aug. 1883 (SGO 46837, type, SGO 46836, isotype). Idem ibid.; leg. M. Espinosa, 7-IX-1935 (SGO 76090, 76091 & 76092). Idem ibid.; leg. C. Grandjot, 15-IX-1933 (SGO 64649). Idem ibid. entre las fisuras de las rocas del primer gran farellón; leg. C. Muñoz et al., 10-IX-1966, seeds (SGO 77013). Idem ibid.; leg. C. Muñoz et al., 15-VII-1974 (SGO 691337). Idem, Cerro San Ignacio; leg. Gertrud Grandjot, (Herb. Rav., Herb Gunckel at Santiago). Culta in Santiago ex bulbis ad Cerro Renca collectis; leg. Ravenna s/n, VII-1975 (Herb. Rav.).

3. AN ADDITIONAL CHILEAN SPECIES OF GENUS **TRISTAGMA**

Tristagma subbiflora (Bert. et Colla) **comb. nov.**

Allium subbiflorum Bertero et Colla, Pl. Rar. 7: 13. 1836.-*Triteleia berteri* Kunth, Enum. Pl. 4: 467. 1843.-*Nothoscordum subbiflorum* (Bert. et Colla) Walpers. Ann. Bot. Syst 3: 636. 18.-*Brodiaea subbiflora* (Bert. et Colla) Baker, Gard. Chron. 1896, 2: 459.

Tristagma subbiflora appears to be closely related to *T. bivalve* (Lindl.) Tr., differing in the smaller size of the whole plant, and the very narrow (1-1.5 mm), opaque leaves. The inflorescence is 1-3-flowered.

II. STUDIES IN THE GENUS NOTHOSCORDUM

1. NEW SPECIES FROM ARGENTINA, BOLIVIA, AND BRAZIL

Nothoscordum boliviense Rav., **sp. nov.** Fig. 26 (Subgen. Platyscordum)

Planta usque 30-45 cm alta. Bulbus oblongo-ovatus ebulbilliferus ad basin perfragilis ad 18-29 mm longus circ. 7.5-12 mm latus in pseudocollo circ. 20-35 mm productus. Folia oblique patentia vel ascendentia ad 15-45 cm longa circ. 1-2 mm lata. Inflorescentia 5-9-flora. Pedicelli floriferi erecti vel erecto-patentes virides circ. 10-22 mm longi. Flores albi praeter basin pallide viridem ad 10-19 mm lata. Tepala lanceolata ad 8-10 mm longa circ. 2.8-4 mm lata. Filamenta lanceolato-attenuata, sepalina 4.5-5 mm longa, petalina subaequilonga necnon ad 0.6 mm ultra sepalina affixa. Antherae post dehiscentiam circ. 1-1.3 mm longae; pollen aurantiacus. Ovarium truncato-aellypticum ad 3.9 mm longum circ. 1.6 mm latum. Stylus fiiiformis albus vel albicans ad 5.9 mm longus. Stigma distincte capitatus.

Plant up to 30-45 cm high. *Bulb* not carrying bulblets, ovoid-oblong, very fragile below, 18-29 mm long, 7.5-12 mm broad, prolonged into a 7.5-12 mm long pseudoneck; outer coats blackish; basal plate oblique, rather wide or at least distinct. *Leaves* few, linnear channelled, bright-green or sometimes almost ash-green and pruinose, subcarinate, striate on the back, up to 15-45 cm long, 1-2 mm broad. *Scape* pale green, almost as long as the leaves, 1.5 mm broad. *Inflorescence* 5-9-flowered. *Flowering pedicels* ascending, pale green, 10-22 mm long. *Flowers* white, pale green below, up to 13-19 mm in diameter. *Tepals* lanceolate, white, without any streak, up to 10 mm long, the outer 2.8-4 mm long, the inner acute, 2.7-3.9 mm broad. *Filaments* lanceolate-attenuate, pale green in the lower half, white upwards, up to 5 mm long, the epipetal series inserted 0.6 mm beyond the episepal series. *Anthers* obliquely versatile, reniform-oblong after dehiscence, 1.3 mm long; *pollen* orange. *Ovary* irregularly ellipsoid-truncate, green, 3.9 mm long, 1.6 mm wide. *Style* filiform, white or whitish. *Stigma* distinctly capitate. *Chromosomes*, $2n = 10$.

Habitat.—Hills and uplands of the Department of Cochabamba, Bolivia, also in North Argentina, in the provinces of Tucumán and Jujuy. In Bolivia, it has been collected on slopes at the Chaguarani gulch, where it grows in a sandy, reddish clay, near *Mastigostyla gracilis* Fost. (Irid.), *Oxalis* sp., *Junellia* sp. (Verbenaceae), and among bushes of *Flourensia* sp. (Compositae), and Malpighiaceae, at an altitude of 2600 m above the sea. It was also seen near Apillapa (region of Anzaldo), on a dark, clayish soil, at 3500 m of altitude.

Specimens: In collibus prope Chaguarani prov. Mizque civit Cochabamba Boliviae; leg. Ravenna 2131, II-1976 (typus in Herbario Ravennae, isotypi TRA, SI). Argentina, prov. of Tucumán, Valle del Tafí; leg. C. Bruch, 1908 (LP 20421). Idem, Estancia Las Pavas, 3000 m; leg. Venturi 4667, 27-XI-1926 (LP, LIL). Prov. of Jujuy, Lagunas de Yala; leg. Cabrera et al. 21278, 12/14-II-1971 (LP). Idem,

Fig. 26. **Nothoscordum boliviense** Rav., upper and side view of inflorescence. Photo P. Ravenna

dept. Yaví, Abra de La Quiaca, on the way to Santa Catalina; leg. Cabrera et al. 17610, 20-I-1966 (LP). Idem, Peña Blanca; leg. H. Tello 27, 16-I-1963 (LP). Idem, dept. Santa Bárbara, Sierra de Santa Bárbara, 2300 m; leg. E. De la Sota 2947, 13-XII-1962 (LP).

A remarkable species because of its narrow, subcarinate, striate, narrowly channelled leaves, and comparatively large, funnel-shaped flowers. In a population from near Apillapa, the outer-tepals were tinged purple on the outer face.

Nothoscordum boliviense is related with *N. arenarium* Hert. Although it is rather difficult to distinguish both species in the dry state, the species is readily separate, in its living state, by means of the leaf morphology. *N. arenarium* has less fragile, slightly channelled, smooth, dark-green leaves. Both species reveal a somatic chomosomes complement of $2n = 10$.

Nothoscordum capivarinum Rav., **sp. nov.** Fig. 27 (Subgen. Nothoscordum)

Species a *Nothoscordo bonariensi* et *nublensi* simile sed foliis late linearibus saepe subplanis ad margines minutissime ciliolatis floribus in omne partibus gracilioribus filamentis albis recedit.

Planta usque 15-20 cm alta. Bulbus ovatus perbulbilliferus albiusculus vel tunicis exterioribus fusco-ochraceis. Folia ad anthesin circiter sex fusco-viridia nitida ad margines saepe minutissime ciliolata vel glabrescentia ad 14-30 cm longa circ. 4.5-9.5 mm lata ad apicem obtusa vel subacuta. Inflorescentia 4-6 flora. Pedicelli graciles ad 14-30 mm longi. Flos albus inferne viridescens leviter fragrans vel inodorus usque 14 mm latus. Tepala lanceolata inferne circ. 1.9 mm connata deinde 6 mm longa, exteriora circ. 3 mm lata interdum stria viridia vel purpurea extus notata, interiora 2.9 mm lata subacuta basin versus saepe stria tenuis viridi extus notata. Filamenta filiformi-subulata alba, sepalina 3.5 mm longa, petalina 3.4 mm longa. Antherae oblongae post dehiscentiam versatiles saepe tortiles ad 1.8-1.9 mm longae. Ovarium late obovatum pallide viride nitidum ad 1.6 mm longum circ. 1.4 mm latum. Stylus teres albus ad 2.7-3.6 mm longus circ. 0.47 mm latus. Stigma simplex subcapitatus. Capsule parva subgloboso-tricocca pauciseminata fusco-viridia. Semina in loculo dua vel unicum subaellyptica vel (si dua in loculo) valde angulata laevia nigra nitentia ad 2.7-2.8 mm longa.

Plant up to 15-20 cm high. *Bulb* ovoid very prolific of bulblets, whitish or covered by thin brownish coats, 18-25 mm long, 8.5-11 mm broad. *Leaves* about six, dark green, with minutely ciliolate margins, or sometimes glabrescent, up to 14-30 cm long, *4.5-8(-9) mm broad*, obtuse or subacute. *Scape* weak, green, 8-17 cm long. *Spathe-valves* marcescent, joined for 2.5-6 mm below, then 10-12 mm long. *Inflorescence* 4-6(-8)-flowered. *Pedicels* weak, green, sometimes laxly recurved before the anthesis, floriferous 14-30 mm long, fructiferous slightly longer. *Flowers* white, greenish at the base, slightly *fragrant* or scentless, 12-14 mm in diameter. *Tepals* lanceolate, joined for 1.9 mm below, then 5-6 mm long, the outer acute, 3 mm broad, sometimes with a green

or purplish streak on the outer face, the inner subacute, 2.9 mm broad, sometimes with a greenish streak on the outer face below. *Filaments* filiform-subulate or filiform-attenuate, weak, white, episepal 3.5 mm long, epipetal 3.4 mm long. *Anthers* oblong, versatile, often twisted, 1.8-1.9 mm long. *Ovary* widely obovate, pale green, shining, 1.6 mm long, 1.4 mm wide. *Style* narrowly cylindrical, white, 2.7-3.6 mm long,

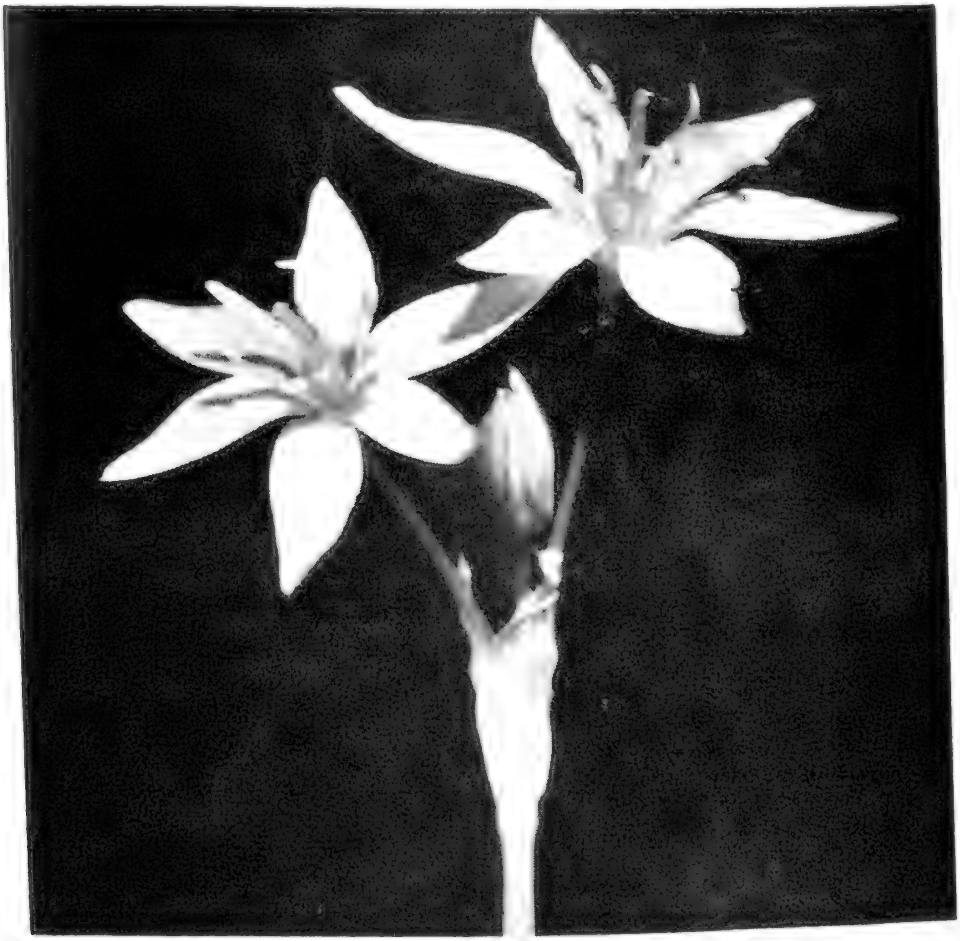

Fig. 27. Nothoscordum capivarium Rav., **sp. nov.,** infloresence. Photo P. Ravenna

0.47 mm broad. *Stigma* subcapitate. *Capsule* almost globost-tricoccous, small, 3-4.5 mm in diam., few-seeded, a dark, shining green. Seeds two or single in each cell, subellipsoid or, when they are two in the cell, angulate, black, shining, smooth, 2.7-2.8 mm long.

Habitat.—Among small rocks near the banks of the Capivarí river at Sesmarías, State of Paraná, Brazil. It grows in sandy soil, closely

associated with *Zephyranthes capivarina* Rav.

Specimens: Culta in Bonaria ex bulbis ad ripas fluminis Capivarí pr. Sesmarías civit. Paraná Brasiliae collectis; leg. Ravenna 1095, XII-1969 typus in Herbario Ravenna, isotypi NY, TRA, K, U, SI, R. RB). Culta in Santiago ex bulbis in eidem locis collectis; leg. ipse 2210, XI-1976 (Herb. Rav.) Brazil, mun. Chopinzinho, Rio Iguazú, Salto Santiago; leg. Hatschbach 36634, 11-IV-1975 (Herb. Rav., Herb. Hatschbach).

This striking species bears the broadest leaves in the subgenus *Nothoscordum*. It rather resembles both *N. bonariense* and *N. nublense*, differing in the often minutely ciliolate, broader leaves, slender parts of the flower, and smaller fruits with one or two seeds per cell. It thrives better under partial shade.

Nothoscordum exile Rav., **sp. nov.** (Subgen. Nothoscordum)

A caeteris speciebus floribus perminutis stylo ovarii breviore latiusculo recedit.

Planta usque 16-35 cm alta. Bulbus subglobosus ad 6-9 mm latus in collo circ. 13-50 mm longo productus. Folia lineari-filiformia circ. 3-4 usque 12-22 cm longa circ. 0.5-1 mm lata. Scapus gracilis ad 16-31 cm longus. Inflorescentia 7-10-flora. Pedicelli erecto-patentes ad 20-57 mm longi. Flores late infundibulati albi in vivo 2 mm longi circ. 4 mm lati. Tepala lanceolata ad basin usque 0.5 mm connata deinde usque 4 mm longa extus stria purpurea notata, exteriora 1.3 mm lata, interiora 1.4 mm lata. Filamenta la ceolato-attenuata alba circ, ad 0.5-0.6 mm e basin tepalorum tubi affixa, sepalina 1.7 mm longa, petalina 2-2.1 mm longa. Antherae luteae pre-dehiscentiam ovato-lanceolatae ad 1 mm longae post-dehiscentiam 0.7 mm longae. Ovarium aellypticum viride usque 1.5 mm longum circ. 0.9 mm latum. Stylus cylindraceum albus ad 0.8 mm longus. Stigma incrassatus subcapitatus. Capsula globosa ad 2.8-4 mm in diametro. Semina in loculo dua vel unicum ovata nigra circ. 1.4-1.5 mm longa.

Plant up to 16-35 cm high. *Bulb* subglobose, 6-9 mm in diam. prolonged into a 13-50 mm long pseudo-neck. *Leaves* 3-4 at anthesis, linear-filiform, up to 12-22 cm long, 0.5-1 mm broad. *Scape* very slender, 16-31 cm long. *Spathe-valves* membranous, hyaline, lanceolate, ventricose below, joined at the base for 1-2 mm, then 3-4.5 mm long. *Inflorescence* 7-10-flowered. *Pedicels* obliquely ascending, 20-57 mm long. *Flowers* white, 2 mm long when fully expanded, 4 mm in diameter. *Tepals* lanceolate connate in a tube for 0.5 mm, externally with a purple streak, up to 4 mm long, the outer 1.3 mm broad, the inner 1.4 mm broad. *Filaments* lanceolate-attenuate, white, inserted at 0.5-0.6 mm from the base of the tube, the episepal 1.7 mm long, the epipetal 2-2.1 mm long. *Anthers* yellow before dehiscence lanceolate-ovate, 1 mm long, afterwards 0.7 mm long. *Ovary* ellypsoid, green, up to 1.5 mm long, 0.9 mm wide. *Style* cylindric, white, 0.8 mm long. *Stigma* thick, subcapitate. *Capsule* globose, 2.5-2.8 mm in diameter. *Seeds* often 2 per cell, ovate, black, 1.4-1.5 mm long.

Habitat.—It grows in stony fields at Cantagalo, in the municipe of Guarapuava, State of Paraná, Brazil; *Sisyrinchium setaceum Kl.* (Irid.), and *Zephyranthes paranaënsis* Rav. are found in the same environment. Also in the municiple of Palma in the same State, at Morro da Baliza.

Specimens: In lapidosis ad Cantagalo mun. Guarapuava civit Paranaënsis Brasilae; leg. Ravenna 1016 et G. Hatschbach (typus in Herbario Ravennae, isotypi Herb. Hatschbach ad Inst. Munic. Bot Curitibae, NY, TRA, K, SI). Idem, mun. Palma, Morro da Baliza; leg. Hatschbach 30736, 19-XI-1972 (Herb. Rav., Herb. Hatschbach, Curitiba).

Nothoscordum goianum Rav., **sp. nov.** (Subgen. Nothoscordum)

Planta parva circ. 10 cm alta. Folia linearia vel lineari-attenuata ad 10-15 cm longa circ. 1-3.5(-4) mm lata. Spathae valvae lanceolate membranaceae inferne usque 1.5-1.8 mm connatae deinde 9.5-11 mm longae. Inflorescentia 6-8-flora. Pedicelli pergraciles 13-36 mm longi. Flores albicantes infundibulati (in sicco) ad 4-8 mm longi circ. 5-8 mm in diametro. Tepala lanceolata inferne circ. 0.5-0.7 mm concrescentia caeterum 5.5-6 mm longum exteriora 1.5-2 mm lata, interiora parum angustiora. Filamenta linear-attenuata, alba, sepalina 2.8-3.3 mm longa, petalina 3.5-4.2 mm longa. Antherae 0.8-1 mm longae. Ovarium viride ad 1.2-1.8 mm longum circ. 0.7-1 mm latum. Stylus tenuiter filiformis ad 3-3.7 mm longum. Stigma minute capitatus.

Small plants, up to 10 cm high. *Bulb* subglobose, 8-9 mm wide prolonged into a 10-15 mm long pseudo-neck. *Leaves* linear, or linear-attenuate, up to 10-15 cm long (?), 1-3.5(-4) mm broad. *Spathe valves* membranous, lanceolate, joined below for 1.5-1.8 mm, then 9.5-11 mm long. *Inflorescence* 6-8-flowered. *Pedicels* 13-35 mm long. *Flowers* whitish, infundibulate, 4-8 mm long, 5-8 mm in diameter. *Tepals* lanceolate, joined at the base for 0.5-0.7 mm, free portion 5.5-6 mm long, the outer 1.5-1.8 mm broad, the inner slightly narrower. *Filaments* linear-attenuate, white, the episepal 2.8-3.3 mm long, the epipetal 3.5-4.2 mm long. *Anthers* 0.8-1 mm long. *Ovary* 1.2-1.8 mm long, green. *Style* narrowly filiform, up to 3-3.7 mm long, white. *Stigma* minute, capitate.

Habitat.—According to the collector of the material designated as the type, the species grows among calcareous outcrops, about 120 km beyond Formosa, in the State of Goiás, Brazil.

Specimens: Brazil, Goiás, 120 km além de Formosa; leg. E. P. Heringer 10747, 16-X-1965 (type NY, isotype UB?). Brazil; leg. Gardner 3472, 1836-1841 (NY, BM).

The species seems to be closely related to *N. bonariense*, and *N. montevidense*. From the former, it differs in the smaller size of the whole plant, shorter filaments and style. The latter has, at least typically, narrower, almost filiform leaves, and bright yellow flowers.

Gardner 3472 from "Brazil", seems to be the same. The bulb is described from this collection.

2. THE INFRA-GENERIC DIVISIONS OF **NOTHOSCORDUM**

Guaglianone (1972), recognizes two sections in *Nothoscordum* sensu Guagl. These are: *Nothoscordum*, and *Inodorum* Guagl. A further section, *Uniflorum* Beauv., she includes in *Ipheion* Rafin., a genus that she believes to be distinct from *Tristagma* Poepp. Additionally, she changes the name *Uniflorum* Beauv. for *Hirtellum* Guagl., with *Ipheion hirtellum* (Kunth) Traub as the type. The reason of her action is that "it may be confused with the section *Ipheion* to which the true *I. uniflorum* belongs".

Adjectival designations may be used, although in their plural form, for such infra-generic groups as Subsection or Series. It would not be convenient to innovate these in this respect. Actually, the use of adjectival forms for Subgenera or Sections, is disapproved by Art. 20A (f, g) of the Code.

Since *Nothoscordum* shows definite evolutionary trends, that are rather more than mere sections, it seems better to consider them in the subgenus rank.

Nothoscordum Kunth, subgenus **Monanthoscordum** Rav., **subgen. nov.**

A subgenus *Nothoscordum* infloreseentia uniflora pedicello spathae breviore differt. Typus: *N. felipponeii* Beauv.

The group differs from the subgenera *Nothoscordum*, and *Enoscordum* (see below), due to the one-flowered inflorescence, and the pedicel which is much shorter than the spathe.

The following species are also referred to this subgenus: *N. vittatum* (Gris.) Rav., *N. setaceum* (Bak.) Rav., *N. hirtellum* (Kth.) Hert., and *N. dialystemon* (Guagl.) Crosa.

Nothoscordum Kunth, subgenus **Enoscordum** Rav., **subgen. nov.**

A subgeneris *Nothoscordum* et *Monanthoscordum* tunicis tenuibus in vivo albicantibus et sicco vinaceis pedicellis gracillimis recedit. Typus: *N. serenense* Rav. Additional species included: *N. andinum* (Poepp.) Kth.

Crosa (1975) proposed the new genus *Zoellnerallium,* with *N. andinum* as the type, basing his statement merely on the chromosome morphology, and color of the bulb tunics when dry. Both characters, in my opinion, do not justify a new genus.

Nothoscordum Kunth, subgenus **Platyscordum** Rav., **subgen. nov.**

A subgeneribus *Nothoscordum Enoscordum* et *Monanthoscordum* caudice bulbi lato foliis saepissime valde latis pallide viridis pruinosis filamentis crebro latiusculis differt. Typus: *N. inodorum* (Ait.) Nich.

Species included: *N. inodorum* (Ait.) Nich., *N. andicola* Kth., *N. entrerianum* Rav., *N. nudicaule* (Lehm.) Guagl., and *N. arenarium* Hert.

Guaglianone (1972), places *N. arenarium* Hert. in this group; this probably is correct. Nevertheless, she includes, some material from the provinces of Catamarca, Salta, Córdoba, and La Rioja, in the species.

The specimens from Catamarca, at least, represent a new species, *N. andalgalense* Rav., which belongs in subgenus *Nothoscordum.*

Key to the subgenera of **Nothoscordum**

1a. Inflorescence one-flowered. Pedicel, even with fruit, shorter than the spathe. Flower comparatively large .... Subgen. 1. **Monanthoscordum**
1b. Inflorescence several-flowered, exceptionally one-flowered in N. montevidense. Pedicel exceeding the spathe, rarely shorter when with flower (in subgen. Platyscordum), elongating afterwards. Flower comparatively small.
2a. Filaments free to the base.
3a. Bulb tunics turning purple when dry .... Subgen. 2. **Enoscordum**
3b. Bulb tunics not turning purple when dry .... Subgen. 3. **Nothoscordum**
2b. Filaments more or less connate at the base, rarely also, irregularly, almost halfway up .... Subgen. 4. **Platyscordum**

3. THE SUBSPECIES OF **NOTHOSCORDUM INODORUM**

Nothoscordum inodorum (Ait.) Nicholson comprises, so far, three well-defined subspecies. Guaglianone (1972, p. 207 & 208) distinguished two "varieties": var. *inodorum*, and var. *macrostemon* (Kunth). Beauv. She includes var. *gracilis* (Driand ex Ait.) Bak., apparently collected in Jamaica, and subspecies *nocturnum* Rav., under synonymy of the latter. Actually, some of the specimens from Entre Ríos that she cites, belong in the subspecies *angustius*, described subsequently. The var. *macrostemon* (Kth.) Beauv. seems doubtful, at least as far as my knowledge goes.

Nothoscordum inodorum (Ait.) Nich. ssp. **angustius** Rav., **ssp. nov.**

A *Nothoscordo inodoro* subspecibus *inodorum* et *nocturnum* floribus parvis gracillibus saepe unilateralibus cernuis usque 8 mm vel minus longis circ. 7 mm latis extus ochraceo-viridescenti-tincti recedit.

It differs from the subspecies *inodorum* and *nocturnum* in the often unilateral inflorescence, with cernuous slenderer flowers; these are, externally, greenish-brown for much of their length, up to 8 mm long, 7 mm in diameter.

Habitat.—Known, so far, only for the eastern part of the province of Entre Ríos, Argentina, near the town of Concepción del Uruguay, but probably extending farther elsewhere. It was found almost as a "ruderal" near the cultivated fields, and meadows.

Specimens: Culta in Bonaria ex bulbis in praedio experimentali agricola Conceptionis-Uruguariae prov. Entre Ríos Argentinae collectis: leg. Ravenna 970, V-1968 (typus in Herbario Ravennae).

This subspecies opens its flowers in the afternoon, as in subspecies *inodorum*. They both have a more or less "infundibulate" perigone. The flowers of ssp. *nocturnum*, however, expand well only at night; the tepals spread horizontally, giving a wheel-like appearance to the perigone.

N. inodorum var. *uruguayense* Beauv. is at present uncertain, possibly referable to subspecies *angustius* Rav.

N. andicola Kunth is an allied species which differ mainly in its linear leaves. The epithet *andicola* has been considered as incorrect by Guaglianone (loc. cit. p. 199); nevertheless, the neutral form, supposedly "andicolum" does not exist. Although Botany is full of

neutral designations for species, Latin does not contemplate the case of neutral living forms that may inhabit *(colere)* a place. *Hordeum andicola,* and *Cercidium andicola,* are other instances.

KEY TO THE SUBSPECIES OF **NOTHOSCORDUM INODORUM**

1a. Flowers funnel-shaped, when fully expanded in the afternoon.
  2a. Flowers 10-12 mm in diameter, greenish, or greenish-brown only near the base .... 1. **N. inodorum** ssp. **inodorum**
  2b. Flowers 6-7 mm in diameter, greenish or greenish-brown, outside, for much of their length .... 2. **N. inodorum** ssp. **angustius**
1b. Flowers wheel-shaped when fully expanded at night .... 3. **N. inodorum** ssp. **nocturnum**

NOTHOSCORDUM SUBSPECIES

1. **Nothoscordum montevidense** Beauv. ssp. **latitepalum** (Guagl.) Rav. **stat. nov.**

Northoscordum montevidense Beauv. var. *latitepalum* Guaglianone, Darwiniana 17: 232, 1972.

This subspecies has obovate, instead of lanceolate tepals.

2. **Nothoscordum montevidense** Beauv. ssp. **minarum** (Beauv.) Rav., **stat. nov.**

Nothoscordum minarum Beauverd, Bull. Herb. Boiss, Ser II, 8: 1001, fig. 3, H-M, 1908.- *N. montevidense* Beauv. var. *minarum* (Beauv.) Guaglianone, Darwiniana 17: 232, fig. 27, 1972.

The leaves are broader, and the flowers more numerous in the inflorescence, than in subspecies *montevidense.*

3. **Nothoscordum hirtellum** (Kth.) Hert. ssp. **lorentzii** (Hert.) Rav., **comb. nov.**

Beauverdia lorentzii Herter, Boissiera 7: 509, fig. 54, 1943.-*Ipheion lorentzii* (Hert). Traub, Pl. Life 5: 50, 1949.- *Nothoscordum lorentzii* (Herb.) Ravenna, Pl. Life 23: 50, 1967.- *Nothoscordum felipponeii* Beauv. ssp. *lorentzii* (Hert.) Ravenna, Pl. Life 26: 74, fig. 21, 1969.

After the study of Guaglianone (1972), it seems clear that subspecies *lorentzii* belong here, rather than in *N. felipponeii.* The whole plant, both in this subspecies and the type, emit a repellent alliaceous smell.

The subspecies *hirtellum,* with six tepals and stamens, inhabit exclusively Uruguay. In contrast, subspecies *lorentzii,* which is tetramerous (eight tepals and stamens), is found only in eastern and northeastern Argentina. Both entities are constant in the number of their verticiles.

III. *CHRYSOCORYNE* REDUCED TO *LEUCOCORYNE*, AND THE NATURE OF "STAMINODES"

Gay (1853, p. 126) describes *Tristagma dimorphopetala,* giving lately a figure of it in his Atlas. The species was defined as having an additional whorl of inner-tepals (hence the speciphic epithet), and six stamens on the inner face of the tepaltube. These supernumerary inner-tepals represented an unusual feature in *Tristagma!*

A close examination of the type-material (at SGO) revealed that, although rather flat these "petals" actually are thick, of the same nature as the appendages of *Leucocoryne.* In the latter genus they are

considered as *staminodes.* How then could the existence of six stamens be explained? Seemingly, there is only one explanation: the tissue of the appendages, in the present species, are part of a not fully apparent staminal cup, which became concrescent with the tepaltube. The latter is strictly interpreted as the joined portion of tepals forming a funnel or tube.

Stemmatium narcissoides (Phil.) Phil. is similar in every respect to *Leucocoryne,* except for the existence of six stamens on the inner face of the tepaltube, and six appendages, each corresponding to a stamen. This fact may prove the assumption that the ''staminodes'' of *Leucocoryne,* and the ''additional whorl of inner-tepals'', in *Tristagma dimorphopetala,* are part of a staminal-cup. This might also be the case of *Tulbaghia,* a South-African genus allied to *Leucocoryne.*

The bright yellow appendages of *Stemmatium narcissoides* are flat, and rather thick, giving to the flower a daffodil-like appearance. This species was first proposed by Philippi (1860) in *Leucocoryne,* and later reclassified by him, using the same epithet, when describing *Stemmatium* (see Philippi 1873). He probably intended to make a new combination.

Zoellner (1973), proposed *Chrysocoryne,* as a new genus, with *Ch. oxypetala* (Phil.) Zoelln. (*Leucocoryne oxypetala* Phil.) as the type. A second species, *Ch. incrassata* (Phil.) Zoelln (*L. incrassata* Phil.), was also included.

As a matter of fact, *L. oxypetala* (lectotype SGO 46765, from ''Copiapó-Pabellón'', leg. San Román) is a typical *Leucocoryne,* probably identical with *L. macropetala* Phil. which has the priority. On the other hand, an examination of the type material of *L. incrassata* Phil. (lectotype SGO 46776), basionym of *Ch. incrassata* (Phil.) Zoelln., reveals that this is a synonym of *L. narcissoides* Phil. (1860).

The genus *Chrysocoryne* Zoelln. must be considered, therefore, as a nomenclatural synonym of *Leucocoryne* Lindl., subgenus *Leucocoryne. Stemmatium* Phil. is reduced to a subgenus of *Leucocoryne.* The entities having three stamens (the epipetal series suppressed) appear as a further evolutionary step, which brought in a diversity of species.

Subgenus *Stemmatium* (Phil.) Rav., *comb nov.* genus *Leucocoryne* Lindl. *(Alliaceae)* Syn.—Genus *Stemmatium* Phil., Anal. Univ. Chile *43:* 551. 1873; *Chrysococoryne* Zoellner, Anal. Mus. Hist. Nat. Valparaiso *6:* 18. 1973 (type: *Leucocoryne narcissoides* Phil.)

KEY TO SUBGENERA OF LEUCOCORYNE

1a. Stamens three, androecium-appendages three .... Subgenus 1. **Leucocoryne**
1b. Stamens six, androecium-appendages three or six .... Subgenus 2. **Stemmatium**

KEY TO THE SPECIES OF SUBGENUS STEMMATIUM (PHIL.) RAV.

1a. Androecium appendages three, epipetal .... 1. **L. dimorphopetala**
1b. Androecium appendages six, the episepal retuse, smaller than the epipetal 2. **L. narcissoides**

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1. **LEUCOCORYNE DIMORPHOPETALA** (GAY) RAV., **COMB. NOV.**

Tristagma dimorphopetala Gay, Hist. Fis. Pol. Chile, Bot. 6: 126, 1853; Atlas Hist. Fis. Pol. Chile 1 (Fanerog.): tab. 69 bis, 1854. - *Leucocoryne gayii* Baker, Jour. Linn. Soc. London 11: 375, 1871. - *Chrysocoryne oxypetala* sensu Zoellner Anal. Mus. Hist. Nat. Valp. 6: 24, 1973.-Excl. syn. *Leucocoryne oxypetala* Philippi, Anal. Univ. Chile 93: 270, 1896 (lectotype SGO 46765).

A rare species inhabiting certain places in the provinces of Coquimbo and Atacama, in the near north of Chile. It is found in the arid, and semiarid bushy steppe.

Specimens: In collibus Arqueros (prov. Coquimbo, Chile); leg. Gay 49a, 1836, (SGO 46740, type). - Chile, prov. Coquimbo, Llanos del Tofo; leg. Wagenehnekt, 15-IX-1943 (Herb. Rav., Herb. Looser at BAS). Idem, Ovalle; leg. V. Castillo de Gunckel, 10-X-1949 (Herb. Rav., Herb Gunckel at Santiago). Prov Atacama, Vallenar; leg. Simpfendörfer, 28-IX-1940 (Herb. Rav., Herb. Gunckel 19160 at Santiago).

2. **LEUCOCORYNE NARCISSOIDES** PHIL.

Philippi, Viaje Des. Atacam., Fl. Atacam.: 52 (Nr. 373), 1860. - *Stemmatium narcissoides* Philippi, Anal. Univ. Chile 43: 551, 1873.- *Leucocoryne incrassata* Philippi, loc. cit. 93: 272, 1896 (lecto-type SGO 46776). - *Chrisocoryne incrassata* (Phil.) Zoellner, Anal. Mus. Hist. Nat. Valp. 6: 24, fig., 1973.

A native of the province of Atacama, Chile. Its range overlaps, in some places, with the proceeding species.

Attempts were made for obtaining good preparations of chromosomes. The species seems to have a complement of $2n = 24$ chromosomes. Cave (1939), reports $2n = 12$ in *Leucocoryne ixioides* Lindl. Since the plants commonly cultivated in the United States as this species belong in *L. coquimbensis* Phil., it is possible that she employed material of the latter, rather than of the former.

Specimens: Chile, prov. Atacama, Cachinal de la Sierra; leg. Philippi (SGO 46752, type). Idem, Carrizal Bajo; leg. King (type of *Stemmatium narcissoides* Phil. SGO 46663, isotype SGO 46661). Idem, Carrizal Bajo; leg. F. Philippi, IX-1885 (SGO 38046, topotype). Idem, Travesía; leg. F. Philippi, IX-1885 (SGO 46662). Idem, Bandurrias; leg. Geisse (SGO 46660). Idem ibid. leg. ipse, 1886 (SGO 38047). Idem, Copiapó? Huasco?; leg. F. Philippi, 1878 (SGO 46664).

IV. STUDIES IN THE TRIBE GILLIESIEAE

1. A NEW **GILLIESIA** SPECIES FROM CENTRAL CHILE

Gilliesia curicana Rav., **sp. nov.**

Species a *G. graminea* affinis sed tepalo interiori-superiore longitudinis alterarum necnon angustiore appendicibus inferioribus columnae staminiferae planiusculis differt.

Scapus debilis circ. 12-30 cm longus. Inflorescentia 4-8-flora. Flores

a pedicello arcte recurvato cernui. Tepala sex; exteriora oblanceolata patentia ad 9.5-13 mm longa, inferius latius; interiora lanceolata reflexa ad 6.7-7 mm longa superius angustius. Columna staminifera ascendens antice ventricosa circ. 4.5 mm longa; appendices posteriores quattuor inconspicuis inaequilongi papilloso-tumescentes a paribus ad tepalos exteriores oppositi; lobi anteriores duis obcordati ad columnam adpressi; appendices laterales sex raro quattuor arquato-ligulati papilloso-tumescentes inter se inaequilongi. Pars libera filamentorum antheriferis perbrevis subtriangularis, laterales petalini conniventes 0.8-1 mm longi, inferius breviore 0.2-0.25 mm longum. Staminodiatria posteriora, paris sepalina linearia circ. 0.7 mm longa, petalinum obtusissimum subnullum. Ovarium subglobosum albicante inferne leviter angustatum ad 1.25 mm latum. Stylus curvato-ascendens oblongo-subulatum ad 2.1 mm longus. Stigma punctatus.

Plant up to 30-40 cm high. *Bulb* ovoid-oblong, 20-24 mm long, 7.5-9 mm wide, covered with brown coats, the basal plate very fragile. *Leaf* single, linear-ligulate, narrowed at both ends but especially downwards, pale green, slightly pruinose, spreading obliquely or almost decumbent, up to 10-20 cm long, 4-5 mm broad. *Scape* cylindrical, weak, pale green, up to 12-30 cm long, 1.8-2.8 mm broad below, 1.2-1.8 mm broad at the apex. *Spathe* bivalved, the valves unequal lanceolate, not marcescent, green, the outer tender, 22-26-5 mm long, clasping at the base, the inner 17-18.5 mm long, often slightly curved, membranous, almost translucent, narrowed above. *Inflorescence* 4-8-flowered. Flower *pedicels* very dissimilar in length, markedly recurvate above, bright green tinged brownish at the recurvate part, up to 25-65 mm long, fruiting often longer. *Flower* invertedly declined or facing obliquely downwards. *Tepals* six, purplish-brown, pale green near the base, the outer oblanceolate, spreading, sometimes slightly incurved, apiculate, both sides slightly revolute below, up to 9.5-12.5 mm long, the upper-lateral pair 2.8-3.2 mm broad, the lower 3.9-4.6 mm broad; inner tepals lanceolate, reflexed from the base, up to 6.7-6.9 mm long, the lower-lateral pair 1.5-1.6 mm broad, the upper 1 mm broad. *Staminal column* sack-shaped, ascending, the front ventricose, up to 4.5 mm long, whitish; back-appendages four, inconspicuous, horn-shaped, papillose-tumescent, opposed by pairs to the upper-lateral outer-tepals, 0.1-1.2 mm long, dark-purple; front-lobes two, obcordate, 1.8-1.9 mm long, adjunct to the staminal-column; lateral-appendages 4-6, tong-shaped, slightly curved, rather flat, disposed by pairs or threes on each side of the basal part of the staminal-cup, the appendages of each set being close together, and dissimilar in length, 1.2-3.3 mm long, papillose-tumescent, dark purple or greenish-purple. *Fertile stamens* three: the lateral epipetal pair, and the lower episepal. *Filaments* deltoid; the lateral connivent, 0.8-1 mm long, the lower shorter 0.2-0.25 mm long. *Anthers* reflexed from the base after dehiscence, simulating extrorse, yellow, connivent, 0.7-0.8 mm wide. *Staminodes* three, the lateral episepal pair, sublinear, 0.7 mm long, the upper epipetal very obtuse, almost obsolete. Ovary subglobose, whitish, slightly narrowed below,

1.25 mm wide. *Style* rather declined, obelavate, up to 2.1 mm long. *Stigma* punctiform.

Habitat.—A native of the first Andean slopes of the province of Curicó, in Central Chile. It was found in a brown, sandy soil, on the slopes near a rocky, torrential river, at Fundo Las Tablas. The species often grows near *Sisyrinchium junceum* ssp. *costulatum* ssp. nov., *Solenomelus pedunculatus* (Irid.), *Bomarea salsilla, Oxalis* sp., and other herbs; *Sophora* sp. (Legum.), and *Aristotelia chilensis* are common bushes in the environment; the tree-representatives *Nothofagus dombeyii, N. oblicua, N. alpina,* and *Cryptocarya alba,* are found nearby.

Specimens: In decliviis secus flumine in praedio Las Tablas provinciae Curicó Chiliae; leg Ravenna 3001, 23-X-1976 (typus in Herb. Ravennae, isotypi NY, K, TRA, E, C, US, SGO). Chile, Talca; leg. C. Grandjot (Herb. Rav., Herb. Gunckel).

The different kind of appendages, and lobes, at the base of the stamical cup were so far considered, in the literature, either as "corona," or "paraperigons". A close examination reveals, however, that these tissue "exerecences" arise from the staminal cup, where they actually belong.

With entire appendages, the species approaches to *G. graminea*. The rest of the species, *G. montana*, and *G. monophylla*, bear broader, fimbriate or snipped appendages. *G. graminea* differs from our species in having the upper inner-tepal obsolete, and almost filiform, non-flat, lateral appendages.

The locality datum "Talca", of the last specimen cited, seems doubtful, or at least incomplete.

2. A NEW **SPEEA** SPECIES FROM CENTRAL CHILE

Speea triloba Rav., **sp. nov.**

A *Speea humili* floribus saepe majoribus filamentis liberis stigmate trifido lobis crassiusculis linguiformibus recedit.

Planta usque 8-11 cm alta. Bulbus ovatus ad 22-32 (-33) mm longus circ. 10-20 (-24?) mm latus tunicis tenuis ochraceo-cinereis membranceis vestitus radicis tenuis capillaceis emitens. Folia linearia basin versus attenuata ad 10-20 cm longa circ. 2.5-4.5 mm lata. Scapus teres gracilis 5-8 cm longus. Spathae valvae membranaceae valde translucideae, exterior lanceolato-attenuata ad 22-24 mm longa inferne marginibus circ. 4-6 mm connatis, interior 15-18 mm longa. Inflorescentia 1-3-flora. Pedicelli distincte deflexi 10-14 mm longi. Flores stellati inferne urceolati ad 30-70 mm lati. Tepala lanceolato attenuata subflagellata ad basin leviter cuculata, exteriora 2.1-5.1 mm longa circ. 4.5-6 mm lata, interiora 17-29 mm longa circ. 3-5.5 mm lata. Filamenta libera triangulari-elongata superne angustata inferne usque 1.5 mm dense glanduloso-papillosa, sepalina 24-25 mm longa, petalina circ. 0.15 mm longiora. Antherea e basin reflexae obovato-aellypticae 1-1.1 mm longae. Ovarium aellypticum ad 2.5 mm longum circ. 1.5-1.6 mm latum; ovula in loculis plura. Stylus teres 2.7 mm longus. Stigma

trifidus lobis lingulatis circ. 0.85-0.9 mm longi.

Plant up to 8-11 cm high. *Bulb* ovoid, 22-32 (-33) mm long, 10-20 (-24?) mm wide, covered by thin, grayish-brown membranous coats: pseudo-neck absent or very short. *Roots* very thin, capillary. *Leaves* linear markedly narrowed downwards, 10-20 mm long, 2.5-4.5 mm broad. *Scape* cylindrical, weak, probably declined 5-8 cm long. *Spathe-valves* membranous, pale, translucent; the outer lance-attenuate, 22-24 mm long, its margins connate for 4-6 mm; the inner smaller, 15-18 mm long. *Inflorescence* 1-3-flowered. *Pedicels* markedly deflexed, 10-14 mm long. *Flowers* stellate, urceolate below, 30-70 mm across. *Tepals* lance-attenuate, subglagellate, slightly cucullate at the base; the outer 2-1-5.1 mm long, 4.5-6 mm broad, the inner 17-29 mm long, 3-5.5 mm broad. Filaments free, almost-triangular, narrowed above, densely glandulose-papillose for more than half of its length; the episepal 24-25 mm long, the epipetal 0.15 mm longer. *Anthers* reflexed from their base after dehiscence, simulating extrorse, obovate-ellyptical, 1-1.1 mm ling. *Ovary* ellypsoid, 2.5 mm long, 1.5-1.6 mm wide; ovules several, about 7-9 in each cell. *Style* cylindrical; 2-7 mm long. *Stigma* trifid, its lobes lingulate, 0.85-0.9 mm long.

Specimens: Chile, prov. Santiago, Cerro Polpaico, Laguna Chicauma, 1700 m; leg. Gertrudis Grandjot, 15-VIII-1940 (type Herb. Ravennae, isotypes Herb. Gunckel 45292 at Santiago, and SGO 76081).

This interesting species, the second in the genus, differs from *Speea humilis* (Phil.) Loes in its larger flowers, free filaments, and trifid stigma. It is known only from the type-locality.

3. **GETHIUM** AND **ANCRUMIA** REFERRED TO THE GENUS **SOLARIA**

Philippi (1858), proposed the genus *Solaria,* with *S. miersioides* Phil. as the type. The species bears three fertile stamens, to wit, the lateral epipetal pair, and the lower episepal one, and three staminodes; the filaments being united for much of their length in a conical column. Reiche (1893), adds another species, *S. major* Reiche, which follows the same pattern.

Ravenna (1967) describes *S. attenuata* Rav., as a new species from the Andes of south-western Argentina and Central Chile. The androecium of this was interpreted, from material available at that time, as having three fertile stamens and one staminode. On examining more specimens later from the type collection, and others from Chile, it was revealed that the supposed "staminode" actually was a small strip of the staminal column, which was broken in that point. The species, therefore, has only three stamens, and no staminodes.

As stated earlier (Ravenna 1967) "*Ancrumia* departs from *Solaria* merely in having only two fertile stamens, and three staminodes, which might be a difference of specific level". *Gethyum atropurpureum* Phil., the only species in the genus, bears three fertile stamens, and no staminodes, as in *Solaria attenuata* Rav. Everything in the vegatative characters perigone, and gynoeceum of *Gethyum,* and *Ancrumia,* agree essentially with *Solaria.* Eventually, the presence or absence of staminodes, and two or three stamens, may be considered as of minor signifi-

cance. In my opinion, *Ancrumia cuspidata* Harv. ex Bak. and *Gethyum atropurpureum* Phil. are better placed in *Solaria.*

Solaria atropurpurea (Phil.) Rav., comb. nov.

Gethyum atropurpureum Philippi, Anal. Univ. Chile 43: 549, 1873. A native of a single ravine of the Cerro San Ramón, near Santiago, Chile.

Specimens: Chile, prov. Santiago, quebrada de Peñalolén; leg. M. Cienfuegos & J. Hernández, X-1871 (type SGO 46712, isotype SGO 46711). Idem ibid.; leg. C. Grandjot, 13-XI-1933 (SGO 64646). Idem ibid.; leg. K. Reiche, X-1909 (SGO 46849). Idem ibid.; leg. ipse, X-1909 (SGO 46850). Idem ibid.; leg. ipse, X-1909 (SGO 46951). Idem ibid.; leg. Gunckel 35911 (Herb. Rav., Herb. Gunckel at Santiago).

Solaria cuspidata (Harv. ex Bak.) Rav., comb. nov.

Harvey ex Baker in Hooker's Icon. Pl. 13: tab. 1227, 1877.

Rather frequent along the coast of the province of Coquimbo, from the mouth of the Limarí river, to the vicinity of the town of Coquimbo and probably further north.

Specimens: Chile, prov. Coquimbo, Parque Nac. Fray Jorge; leg. C. Jiles, 22-VIII-1948 (SGO 70826). Idem ibid., lomajes, 170 m, 22-VIII-1948 (SGO 70827). Quebrada La Placa, cerca de la torre, en el camino a Tongoy; leg. R. Wagenknecht 138 W, 19-VIII-1943 (SGO 60486). Idem, prope marem ad latum-septentrionalem oris fluminis Limarí; leg. Ravenna 1410, VIII-1971 (Herb. Rav.). Idem, Coquimbo, Guayacán; leg. Gunckel 45306, 18-IX-1934 (Herb. Rav., Herb. Gunckel at Santiago), in fruit. Idem, Cerro Pan de Azúcar, cerca de La Serena; leg. Gunckel 296, 3-VIII-1948 (Herb. Gunckel 41389 at Santiago, Herb. Rav.).

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FURCRAEA BOLIVIENSIS NOV. SP. (AGAVACEAE)

PIERFELICE RAVENNA,

Universidad de Chile

While exploring in the department of Cochabamba, Bolivia, in March 1976, an apparently new species of *Furcraea* (Agavaceae), was discovered. Several small populations were investigated, unfortunately without success, in an attempt to find flowers. Nevertheless, since it is easily separable from the rest of the species, I am describing it from the vegetative characters. It is the only species of the genus, so far recorded, that truly belongs in the Bolivian flora. Others as *F.* aff *occidentalis* Trel., and *F. foetida* (L.) Hawk. (syn. *F. gigantea* Vent.), are sometimes seen as escapes.

F. boliviensis apparently is the species associated, with some doubt, with *F. longaeva* by Trelease (1929). This author says: "A similar if separable species is reported for Bolivia". Foster (1958), recorded in Bolivia a "*Furcraea* sp."

The species seems to be related with *F. pubescens* Tod., a native of Mexico, rather than with *F. longaeva*, which, according to Baker (1888), has a 12-15 m long trunk. *F. andina* Trel. is an allied species, with prickles normally reaching 6 mm or more in length.

A small-sized plant is now cultivated, near buildings, at the Reserva Florestal Federal "Cabeza de Veado", in the vicinity of Brasilia city; another with me at Santiago.

Furcraea boliviensis Rav. **sp. nov.**

Planta usque 90-100 cm alta circ. 1-1.40 m in diametro inferne stipite lignoso saepe subreptante crasso ad 30-40 cm longo circ. 10-15 cm lato instructa. Folia rosulata ensiformia rigida saepe patentia modice canaliculata cinereo-viridia haud pruinosa ad 45-55 cm longa rarius ultra circ. 8-10 cm lata prope basin leviter angustata ad lateras spinis uncinatis parvis inter se valde proximis ad apicem aculeo unico armata.

Plant up to 90-100 cm high, 1-1.40 m in diameter, with a short sometimes prostrate, stout trunk below; this 30-40 cm long, 10-15 cm

Fig. 28. **Furcraea boliviensis** Rav., **sp. nov.**, two plants brought down to Chaguarani from type locality. Photo P. Ravenna

wide. *Leaves* rosulate, ensiform, rigid, often spreading, moderately channelled, thick, an opaque ash-green, up to 45-55 cm long, rarely longer, 8-10 cm broad, slightly narrowed near the base, bearing on both sides, rather proximate, uncinate, small prickles, not exceeding 3 mm in length, and, at the apex an acute pungent point.

Habitat.—Rather infrequent on the mountains of the province of Mizque, Dept. of Cochabamba, Bolivia. It forms small populations, under partial shade, growing among rocks or simply on the slopes, in a dark, sandy soil, commonly at 3500 m of altitude. It is also found at 2600-2700 m near Chaguarani, in the same province, but possibly brought there in some manner by man; in the latter area it grows in a sandy, reddish clay. The same or an allied species, inhabits the slopes with philitic stones, in the drier, warmer region between Aiquile and Sucre.

Specimens: Prope cacuminem montis supra argentifodinam "Asientos" ad viam Chaguarani prov. Mizque civit. Cochabamba Boliviae; leg. Ravenna 2305, II-1976 (typus in Herb. Rav.).

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PLANT LIFE LIBRARY

ORGANISMIC EVOLUTION, by Verne Grant. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1977. Pp. 418, 66 illus. $15.95.—The primary aim of the author has been to write "a good general book on evolution, of potential interest to a wide range of readers, and, within this broader objective, the secondary goal was to shape the book to fit the specific needs of students." In this the author has succeeded to a remarkable degree. The subject is presented with a fresh outlook, concisely and clearly giving a sound foundation upon which the student can build. The problems encountered are stressed in the introduction. The rest of the text deals with macroevolution, natural selection, the problem of acquired characters, speciation, macroevolution, from organic to human evolution, and social implications. A key to technical terms, a bibliography, and authors, organisms and subject indices complete the volume. Most highly recommended to all interested in biology. What would I not have given to have had such an inspiring text during my student days.

EVOLUTION, by Theodosius Dobhansky, Francisco J. Ayala, G. Ledyard Stebbins and James W. Valentine. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1977. Pp. xi + 572. 174 illus. $15.95.—This profusely illustrated text on evolution by a group of outstanding biologists is essential reading for all interested in modern biology. There are sections on the nature of evolution; the genetic structure of populations; the origins of hereditary variation; natural selection; populations, races, subspecies; species and their origins; patterns of speciation; transspecific evolution; phylogenies and macromolecules; the geological record; cosmic evolution and the origin of life; evolution of procaryotes and unicellular eucaryotes; evolutionary history of metazoa; evolution of mankind; future of

evolution, and philosophical issues. It has to be pointed out that in considering kingdoms of organisms, it has been shown by Vogel, Thompson & Shockman (Vol. 20. Gen'l Microbiol. Symposium, Cambridge Univ. Press. 1970, pp. 107-119; and Traub (Plant Life **33:** 85-104. 1977), that the **"Kingdom Protista"** as proposed by Whittaker (Science **163:** 150-160. 1969), and Margulis (Handbook of Genetics. ed. R. C. King. Vol. I. Plenus Press, pp. 1-41; Taxon **25:** 391-403. 1976), is unreal because it would include organisms **with different lysine synthesis paths DAP and AAA;** such organisms **ranging from Plantae, Mycotae and Animalia.** Literature references and an index complete the volume which is very highly recommended to all interested in biology.

INTERMOUNTAIN FLORA: VASCULAR PLANTS OF THE INTERMOUNTAIN WEST, U. S. A. VOL. 6. MONOCOTYLEDONS, by A. Cronquist, A. H. Holmgren, N. H. Holmgren, James L. Revel and Patricia K. Holmgren. Columbia Univ. Press, 562 W. 113th St., New York City 10025. 1977. Pp. 584. Illus. $54.00—This outstanding volume on the Intermountain U. S. A. Flora fills a long felt need. The vascular plants of the Class **Liliopsida** covered include Orders Alismatales, Hydrocharitales, Najadales, Commelinales, Juncales, Cyperales, Typhales, Arales, Liliales and Orchidales. The taxa of Class **Liliopsida** are arranged according to subclasses, orders, families, genera and species. A list of nomenclatural innovations and an index complete the volume. Very highly recommended to all.

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WATER AND PLANT LIFE; PROBLEMS AND MODERN APPROACHES, edited by O. L. Lange, K. Kappen and E.-D. Schulze. Springer-Verlag New York, 175 Fifth Av., New York City 10010. 1976. Pp. xx + 536. Illus. $52.80.—The authors present a synthesis of the wide-ranging work of specialists in this field in seven parts: (1) fundamentals of plant water relations, (2) water untake and soil water relations, (3) transpiration and its regulation, (4) direct and indirect water stress, (5) water relations and CO_2 fixation types; (6) water relations and productivity, and (7) water and vegetation patterns. Plant species and subject indices complete the volume. Highly recommended.

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[AMERICAN AMARYLLIS SOCIETY, continued from page 6.]

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AMARYLLIS
YEAR BOOK

1979

Amaryllis papilio Ravenna
Native to the state of Santa Catarina, Brasil
Discovered in 1967.

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PLANT LIFE

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EDITED BY

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PLANT LIFE, VOLUME 35, NOS. 2—4, INCL., 1979
GENERAL EDITION

ILLUSTRATIONS

CORRIGENDA

PLANT LIFE Vol. 33. 1977

Page 83 1st paragraph, DESCRIPTION, 5th line, for "Flare of tepals, 1.1 cm to 3.8 cm," read 1.1 cm to 1.3 cm."

2nd paragraph, 3rd line, for "Another closely clustered", read "Anthers closely".

CORRIGENDA—continued on page 85

PLANT LIFE, VOL. 35, No. 1, January, 1979

AMARYLLIS
YEAR BOOK
1979

Year Book of

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46th Issue

General Amaryllid Edition

EDITED BY

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(AMERICAN AMARYLLIS SOCIETY, continued on page 125.)

PREFACE

The interesting cover by Penrith B. Goff, featuring *Amaryllis papilio* Ravenna, is based on a photo print furnished by Dr. James E. Shields of the Amaryllis Research Institute, Indianapolis, Indiana.

This 46th issue of the Amaryllis Year Book is dedicated to Harry Blossfeld, the renowned South American plant collector, and Amaryllidarian, who contributes a charming Autobiography and an article on an undescribed *Amaryllis* species. For his outstanding contributions to the advancement of the Amaryllids he received the 1979 WILLIAM HERBERT MEDAL.

Fig. 1. Sam Caldwell, Dean of the Lycorisarians, Nashville, Tennessee, contemplating the success in growing frost tender **Lycoris,** mainly **L. elsiae** and other commercial **"albiflora"** variants. When grown outside in this area, the foliage is so badly winter-damaged that they seldom bloom; with plastic covered sash for winter protection, they flower abundantly. Photo by Sam Caldwell

In this issue we celebrate also Sam Caldwell, the Dean of the Lycorisarians, who has devoted thirty years to *Lycoris* culture and

breeding (see Fig. 1). He reports success in getting seed set on *Lycoris squamigera*, a feat that so many of us have tried without results. He also presents his 1939 report. (See also 1964 PLANT LIFE.)

We are particularly happy to include articles by Dr. James E. Shields, President of the Amaryllis Research Institute. His work will till a field which the American Plant Life Society has not been able to cultivate since its main efforts have been directed toward the diffusion of knowledge about the introduction, breeding and culture of plants and the biographical details about persons connected with plant advancement. The Amaryllis Institute will devote its efforts to preserving viable breeding colonies of the various species of *Amaryllis*, and will also be concerned with the breeding and physiology of the various species. We welcome this new institution for the advancement of *Amaryllis* and congratulate Dr. Shields on a good start.

Mr. Cothran reports on yellow-, and pastel flowered hybrid *Amaryllis*; Dr. Bell writes about *Amaryllis* for breeders; Mr. Deme up-dates his progrom for breeding double-flowered *Amaryllis*; Kaiker and Singh, in India, report on the role of mutation breeding in *Amaryllis*; Mr. Myake, in Japan, reports on his breeding program for 6-8 flowers per umbel in *Amaryllis*, and Mr. Gerson emphasizes the need for a well-rounded *Amaryllis* breeding program.

Dr. Howard and Sr. Ravenna describe new *Hymenocallis* species from southern Mexico. Dr. Howard reports on the Woelfle and other *Hymenocallis* hybrids, and Dr. Shields contributes notes on *Hymenocallis*. Mr. Tisch writes about dwarfing from chemoalteration. Mr. Bennett contributes notes on *Crinum japonicum*; and the Mueller-Doblieses report on the morphology of *Ungernia*.

There are Regional reports from the Zephyrantheae Committee by Mrs. Marcia C. Wilson; the General Amaryllid Report from Mr. Bennett; the Alstroemeria Committee by Mr. Duncan, and the North Midland by Dr. Shields.

Mr. Speed reports on blooming Zephyrantheae; Mr. Manning writes on growing *Amaryllis* and other plants in the North; Mrs. Forberg reports on growing Amaryllids in Virginia; Mr. Craft writes about *Amaryllis evansiae*, and Mrs. Lewis on the growing of the Eucharis Lily in California.

Mr. Roberts writes on the growing of Hemerocallis in southern California; Mrs. Wilson presents a charming report on the Sabal Texana Sanctuary in southern Texas.

There are still other contributions, as shown by the Table of Contents, including the reports on the Amaryllis shows in 1978, and Mrs. Pickard's Course on the judging of Amaryllis exhibits at the Regional Shows.

Contributors to the 1980 issue of the AMARYLLIS YEAR BOOK are requested to send their articles by August 1, 1979, in order to insure earlier publication of this edition. Unless articles are received on time, publication will again be delayed to June or July or even later as with some issues in the past. Your cooperation toward earlier publication

will be greatly appreciated. *Those having color slides or transparencies which they wish to use as the basis of illustrations are requested to have black-white prints made, and to submit these with their articles.*

January 15, 1979, *Hamilton P. Traub*
2678 Prestwick Court, *R. Mitchel Beauchamp*
La Jolla, California 92037 *Thomas W. Whitaker, Harold N. Moldenke*

DEDICATED TO

HARRY BLOSSFELD

HARRY BLOSSFELD - HERBERT MEDALIST

HARRY BLOSSFELD

An Autobiography

The BLOSSFELD family originated in Thüringen, Germany, a reknowned center of horticulture. My forefathers were mostly horticulturists and my grandfather Carl Blossfeld, founded a nursery at Cölleda. He had two sons, both professional gardeners, and three daughters, all of them trained as florists. The two sons learned in Erfurt and Hildesheim, practiced in Belguim and became head growers at several famous orchid nurseries in Europe.

My father Robert Blossfeld settled at Potsdam, where he started in 1913 a seed and plant import and export firm. By the outbreak of World War I, he lost all merchandise, capital and trade connections. In 1920 he made a second start and already in the thirties, the firm expanded by world wide trade connections, including the introduction of *Kalanchoe blossfeldiana* to horticulture. In the sixties, the firm was reestablished at Lübeck, West Germany, under management of the writer's sister.

I inherited my scientific inclination certainly from my mother's family; my grandfather was a keen horticultural amateur and a relative of Andreas Voss, who was author of several important botanical encyclopedias and horticultural books in the 19th century. It is little wonder that I followed such massive traces of tradition. I had the benefit of professional advice in horticultural practice from my father and both grandfathers and an excellent scientific education, granted by the generosity of my father.

I was born February 27th, 1913 at Potsdam, Germany, in the very year when my father started his first independent enterprise. After college, I first entered as apprentice in the reknowned nursery of the Sanssouci Park at Potsdam, where the director Paul Kache instructed his pupils one day each week in his excellent teachings on the theory of horticulture. I later had a year's practice at Hahn's Cactus Nursery in Berlin-Lichterfelde and attended the Horticultural School at Berlin-Lichterfelde, under teachers Jessen and Breschke. This was a government establishment, and in concluding the course, I obtained the official certificate of horticulturist and was distinguished as the best scholar of the year by the award of the "Beckmann" premium. I then immediately matriculated as a student of botany at the Botanical Garden & Museum of Berlin-Dahlem. There I had famous botanists as teachers: Diehls, Pilger, Werdermann, Kolkwitz, Czaja, Noack and Markgraf.

In those years, the democratic government in Germany was overthrown by Hitler. Since the students made continuous protests, drastic disciplinary measures were imposed on them which converted the German universities into barracks of *premilitary* instruction; students had but little time left for study. In my particular case it was discovered that my father had been elected repeatedly a secretary of a horticultural association and by malevolence, this was classed as "trade-unions leadership" and thus, my father suddenly had become politically

suspect, his liberal ideas aggravating the situation. This reflected unfavourably on my own career as a student. Talking over the matter with my professors, they decided to sponsor for me a special license for making botanical studies in South America.

Botanical exploration in South America had been for a long time discussed in our family; Professor Werdermann, the famous cactus specialist, had been a frequent guest in our house and his stories about his travels in Chile, Bolivia and Argentina had fascinated us all. My father had permanent plant collectors and orchid hunters in South America and there was a big market for novelties in cacti and succulents in the thirties. By curious coincidence, an old cactus collector of my father submitted a plan to collect 5000 cactus plants of the miniature type, including at least 10% of new species, within six months, if he could obtain funds to pay the expenses.

Funds became available through my fathers clients in the United States of America, in England, France, Italy and as far away as New Zealand and Australia. When I got exemption from the obligatory student's "Volonteer Work Year" proving that I had worked two years as a horticulturist, I got my passport and permission to leave Germany—not an easy matter in those days. The remainder of 1934 was spent with an exhaustive study in the Museum's library, of the flora of the Andes Mountains in South America.

I sailed early in 1935 to Buenos Aires, Argentina. Already during the ship's voyage I succeeded in improving my very rudimentary knowledge of the Spanish language and on arriving, I was able to make myself understand. An old plant collector of my father, Oreste Marsoner, had agreed to lead me to the best hunting grounds for cacti. We bought a second-hand pick-up Ford T-Model, hired a driver and started the daring venture of collecting and shipping five thousand Dollars worth of live plant material, to pay off the assumed contracts. The task challenged the mind and physical and mental capacity of a 21-year old greenhorn.

The guidance of an experienced plant collector was, under these circumstances, an invaluable asset. By strenuous efforts of us all, leading a Spartanic life, sleeping in a tent for months, searching the wilderness beyond the roads with native guides on muleback and shipping the collected materials by railroad back to Buenos Aires, we succeeded, after seven months of travels, to gather the larger part of the required wild plant material. Our travel route crisscrossed the following provinces in Argentina: Córdoba - San Luis - San Juan - La Rioja - Catamarca - Tucuman, Salta - Los Andes - Jujuy, ending at the boundaries of Chile and Bolivia.

Among the several hundred different species of cacti, we registered about one hundred supposedly new species which were described as soon as they flowered in Europe, unfortunately not always with the necessary complete range of observations. Of course we also collected other interesting plants: Bromeliads, Orchids, and also several Amaryllids. One of our most exciting discoveries was a big grove of *Amaryllis immaculata* in the Quebrada del Toro, Province of Salta, of which we shipped a lot of bulbs to Messrs. Tubergen in Holland and

a few dozen to Las Positas Nursery in California. We found also several *Zephyranthes, Bomarea, Cypella, Habranthus* and two *Amaryllis* species which were never identified.

My second collecting expedition started January, 1936 and had the purpose of searching for seeds at the most promising areas for cacti, that we had discovered during our first trip. I travelled alone this time, to reduce expenses. The whole output of seeds, was shipped to my father's firm, which distributed these seeds in Europe. Even now, forty years later, from these seeds new cactus species have been raised and described.

When I arrived at the boundary of Bolivia, the Chaco-War between Bolivia and Paraguay had just been ended by on armistice. It was not without difficulties, to obtain a passport visa to travel in Bolivia, but I succeeded visiting the pre-Andean mountains of southern Bolivia, around the beautiful town of Tarija, during six weeks. Most of the plants gathered there were new species.

After crossing the Bolivian Altiplano from south to north by the "Transandino Railway" I paid a short visit to La Paz and visited the famous Inca Ruins of Tihuanaco, crossed Lake Titicaca in an Indian sailing-boat and entered Peru for a period of six months.

This was my first travel in Peru, and I decided to concentrate my collections in three areas, in the south, center and north of that country, where communications are easier. My first headquarters were at Arequipa, where I explored the foothills of Chachani and Misti Volcanoes and the desert Pampa de las Joyas, where I found the *perfect imitation of a lunar landscape* than may be found on earth, the only place that I remember to be *totally bare of any vegetation.* Though still terribly dry, the Pacific Coast of Peru benefits from seasonal drizzling rains and consequently shows a permanent flora of cacti and a short-lived but vigorous cover of herbage in which *Hymenocallis* species with white or yellow flowers are examples of outstanding beauty.

My second headquarters were at Lima, the capital of Peru. Presenting myself to Professor Weberbauer at San Marcos University, I obtained first-hand informations on prospective collecting areas for cacti and I also had the privilege of partaking in a botanical excursion to the Amancay Hills to admire millions of *Hymenocallis* in bloom under the drizzling rain and a confusing mist of that season. Working my way from Lima up the Andes, along the famous Inca-Road to Oroya at 15.000 feet altitude, I penetrated the eastern slope, sources of the Amazon River, with a moist, subtropical climate, where I gathered a fine collection of orchids for the New York Botanical Garden. Going back to Lima, I packed and shipped my plant collections and after a visit to the Agricultural Experiment Station of La Molina, decided to make a little excursion on foot into the desert hills, where almost every valley contains treasures of rare or even new species of cacti. On this excursion, I became so fascinated by the incredibly colorful glow of the approaching sunset, that I entirely lost my way and only realized it, when suddenly and almost abruptly, darkness envolved me. In that pitch-dark night I had to stumble my way out through twelve miles of

steep sandy hills, aiming at the Pan American Highway that runs along the coast. I still think, the inconvenience was worth while to admire the sunset in the desert of Peru.

From Lima I travelled by Pan American Highway to Piura, near the boundary of Ecuador. The district of Ayavaca is rich in orchids, bromeliads and cacti and in former centuries, the woods furnished hundreds of tons of china-bark, a specific remedy against malaria fever. The trees that produce this bark are now practically eradicated. Returning from an excursion, with a bagful of orchids, bromeliads and cacti, I met an automobile without anyone in it, on that desert road, and while still wondering about the empty car parked at the roadside, there emerged from the jungle *first the Peruvian driver and then the passenger: Professor Weberbauer.* Our surprize about this casual meeting was mutual and soon we showed each other our collected plant material and the professor told me he had made this collecting trip to observe and gather material of the various *Cinchona* species which furnish china-bark. In spite of the scarcity of these trees, he had been successful and I received a two-hour lesson on the history, early exploration and almost eradication of these trees, which led English and Dutch explorers to gather seeds and small plants for transfer to India and Indonesia, where plantations were started successfully. I was so impressed by this story, that during the following forty years I gathered informations and literature on the matter and hope to publish a book on the history of the Chinine-Tree.

I returned to Buenos Aires by steamer, via Chile, crossing the Andes Mountains between Santiago and Mendoza. After a month of rest in Buenos Aires, I combined a third collecting expedition with my former guide Marsoner. We searched in Northeastern Argentina, northwestern Uruguay and southern Brazil, during a month, completing our cactus collections. On this travel, we met the remainders of 17th century plantations of the Mate Tree, started by the Jesuit Missionaries and which were presently being restored by encouragement of the Argentine Government. The French botanist Bonpland had pioneered the idea of Mate plantations. Mate is the almost exclusive tea used in Chile, Argentina, Paraguay and southern Brazil.

On my arrival at São Paulo in Brazil, by end of 1936, I had the satisfaction of fulfilling my contracts to the entire approval of my clients, but had not made a profit, except the thrill and the experience of two years of travels in South America. My original plan had been of course, to return to Germany and settle down to a scientific career. However in those years of pre-war tensions prospects for concluding my studies at the German universities were frankly discouraging. Friends in Brazil warned me that there would be war in Europe. When my father wrote me that he had orders for several consignments of orchid plants, I therefore decided to collect and ship these plants, trying to make a sufficient profit for a prolonged stay in South America, until the situation in Europe had quieted down.

Thus, early in 1937, I definitely embarked on a career as plant collector. I soon became captivated by the prodigious flora of Brazil.

admiring the beautiful landscape scenes, familiarizing myself *with* the Portuguese language and profiting from the then very low cost of living, and, last but not least, getting married. Surplus plants brought back from my numerous collecting trips were at first planted in the gardens of several friends, but soon I bought a suburban tract of land, installed lath houses and shade trees and later converted this into a private botanical garden. By exchange of seeds and plants, I got exotic species too and my garden tends to be perpetually overcrowded.

During excursions into the Organ Mountains, I re-discovered *Worsleya raineri* and shipped a few bulbs and seeds to California and Holland, and wrote a report on that plant for "HERBERTIA, 1938". I also found and started growing bulbs of *Amaryllis aulica* and several other Brazilian *Amaryllis* species. I had a nice collection of Gesneriads and of *Begonia* species and my wife, who is interested in plants as I am, developed a fancy to ferns and *Philodendron, Anthurium* and other aroids.

My father, though understanding my decision to stay in South America, never really approved the idea of abandoning a scientific career. With the secret purpose to persuade me to return to Europe and "invest my experience", he sailed July, 1939 to Brazil, not suspecting the imminence of war. By the outbreak of World War II, much against his desire, he could not return and decided to dedicate himself to the care and development of my plant collections.

As a consequence af the war, plant and seed exports to Europe ceased almost immediately and we had to adapt our small nursary to keep going as a local business, supplying the Brazilian orchid amateurs with suitable plants. Our assortment of Brazilian native species had to be enlarged by others from Colombia, Peru, Ecuador, Venezuela and Mexico. To supply this need, I decided to make another collecting expedition.

The first task was to re-discover the habitat of *Cattleya rex,* found 1890 by Bungeroth in eastern Peru and which had since completely disappeared from cultivation. After three months of strenuous travels and search in the valleys of Maraõn, Huallaga and Ucayali I succeeded in obtaining the necessary number of plants, most of which were shipped to the United States and a few to São Paulo. During this travel I found a different *Cattleya* with smaller yellow flowers, which has since been described as *C. blossfeldiana* but which I believe to be a supreme geographical form of *C. lutcola* of Brazilian origine. On my way to Colombia I crossed Ecuador and had opportunity of collecting *Cattleya maxima,* another rare and beautiful orchid species.

In Colombia I remained six months, mostly engaged in collecting orchid plants for horticultural firms in the United States, and of each good commercial species, I shipped a few cases to Brazil. When the U.S. declared war against Germany, my letters of credit on account of orchid shipments were frozen since I was a German citizen. Almost simultaneously, the Government of Colombia put in force a law, forbidding strictly exports of live plants from wild sources. An absurd consequence of this was, that a splendid lot of eight hundred plants of

Cattleya warscewiczii ready for shipment to New York was confiscated at the pier of Barranquilla and officially incinerated. Besides, there were evident signs that in short, the government of Colombia too would declare war against Germany and in that case, I would have to stay in an internment camp. Therefore I tried to return to Brazil and to join my family as quickly as possible. I had not sufficient money to return the same way I had come, nor could I return by ship. There was no air connection to Brazil at that time.

I decided therefore, to return by Caqueta and Putumayo Rivers, right across the "Green Hell" of upper Amazonas. This travel was neither easy, nor quick, nor safe. The first part, made by dugout-canoe was frankly daring and tiring and reminicient of the account published by the English botanist Richard Spruce, who made the same trip in the opposite direction, 83 years earlier.

I arrived at Manaos in Brazil, seriously ill, shivering with fever and physically exhausted. My health was restored by competent treatment under Dr. Canuto de Azevedo at Belem of Pará; this gentleman was an enthusiastic orchid amateur and had bought many plants from me in previous years.

After arrival at São Paulo, though still in failing health, I was still dedicated to orchid growing. In 1944 my father died and a year later a pulmonary affection, which made it necessary for me to retire from horticultural activity for many years.

Forced to a stricted activity, I became a member of the Editorial Staff of a Brazilian Agricultural periodical; published several books on horticulture and gardening in Brazil, and studied all botanical and horticultural literature I could obtain. In 1964 my health was restored by thorax surgery, but my physical strength is impaired by bronchial deficiency, which puts an end to further botanical exploration travels.

After 1965, I contracted service with several public and private institutions, as advisor for botanical and horticultural problems, and collaborator with landscape architects and city development projects. During periods of less activity, I divide my time between botanical studies of living plants and writing. Actually I am finishing a manuscript of the Second Edition of my book on Gardening in Brazil, which I expect to finish this year. Future plans include historical studies on several economic crops, among which are: Coffee, Vanilla, China-Bark, Brazilwood, Sugarcane, Cacao and Mate. All of these plants had important roles in the economic and political evolution of Latin America.

As to my engagement with *Amaryllis* cultivation, collection and study, I have a nice collection of species, totalling some 120 to 150 plants in pots. My idea is to transfer this collection to another locality with a milder and more equable climate than we have here at 3000 feet altitude. I expect to plant them out in beds, under the light shade of small-leaved trees. After retirement, I will then have a better chance to observe them under optimum conditions than presently.

I believe, that many more Amaryllids exist unknown and that several of the described species are yet imperfectly studied and require amendments to their old "classic" diagnosis. I strive to maintain my

species material pure, avoiding cross-pollination. In the past, I have distributed pure species seed to many individuals and institutions all over the world, but rarely I have received later comments of the resulting plants. People seems to keep their information a secret, or dislike to communicate their observations.

Therefore I am convinced that publications in the style of the Plant Life Magazine are an excellent means to acquaint plant lovers with each other, and document observations, experiments and habitat reports on new or little known species.

NOTES ON AN **AMARYLLIS** SPECIES FROM BRASIL

HARRY BLOSSFELD, *Rua Pedro, 360 - 02371,*
02371 - São Paulo, Brasil

Bulbs were gathered in full bloom, growing in crevices of a steep granite rock known as "Pedra Grande" near the little town of Atibaia, 67 kilometers north of São Paulo, collected February, 1972.

Bulbs measured 42 cm (=16½") in circumference or 14 cm in diameter. Shape globular, with a 10 to 15 cm long neck, clothed by brownish-black tunics. Bulbs are not stoloniferous and mostly grow singly.

Leaves emerge after flowering, from 8 to 11 per bulb. Measure 100 to 120 cm long and up to 5.5 cm broad, being shallowly keeled, pale green with a pruinous greyish tunic and a very narrow greyish rim.

Flower scape 40 to 42 cm long, hollow, slightly oval in cross section, tapering from 1.8 cm diameter at base to 1.5 cm at tip, pale green and covered with a greyish pruinous powderly coating and slightly reddish near the base. Season of blooming: late summer and early fall, that is in southern Brazil, February to April. Sometimes repeating six months later.

Umbel two-flowered, from two green *spathe valves* that wither while flowers open and measure 2.2 cm broad and 8 cm long. Two narrow bracteoles of 5.5 cm length. *Pedicels* at anthesis 3-6 cm long and 0.6 to 0.8 cm in diameter. When *seed pods* are ripe, *pedicels* have elongated to 12 to 15 cm in length.

Ovary 1.6 cm long, almost cylindric, 1 cm diameter and vividly contrasting by the lustrous green colour against the pruinpus pedicels.

Tepaltube about 1 cm long, clear green, with a triangular opening, showing a border of tiny denticulations or scales of pale green colour.

Perigone wide spread open, making a stately big flower of up to 18 cm diameter; length, measured (without tepaltube) of 12 cm. Segments are almost equal, between 3.5 and 4.5 cm broad, the lowermost only slightly narrower. Each segment has on its back a prominent green keel. General colour is a bright pastel red.

Inside pattern of perigone is characterized by six pure green central stripes radiating from the center to 2/3 length of each segment; on both sides of this central stripe is a purple area, from which radiate about 10 purple veins to each side, some of these forked and diluting into the reticulate marginal and apical areas, of the same bright *pastel* red colour of the outside of flower.

Style 12 cm long, green at base, then crimson. *Stigma* trifid, with 0.4 cm long branches, crimson at anthesis, showing a white surface after spreading apart.

Filaments 10 cm long, green at base, tips crimson. Anthers on anthesis to 1.2 cm long, grey to pale violet; after splitting, showing yellow pollen and shrivelling considerably in size.

Seed pods (fruit) takes two months to ripen and show remarkably big dimensions: 5 cm in diameter and 4 cm in length. *Ovules* about 180 per pod, but rarely more than 100 to 120 seeds are developed. *Seeds* are of a more rigid texture than most other *Amaryllis* species, measuring 14 by 11 millimeters and are mostly D-shaped and glistening black.

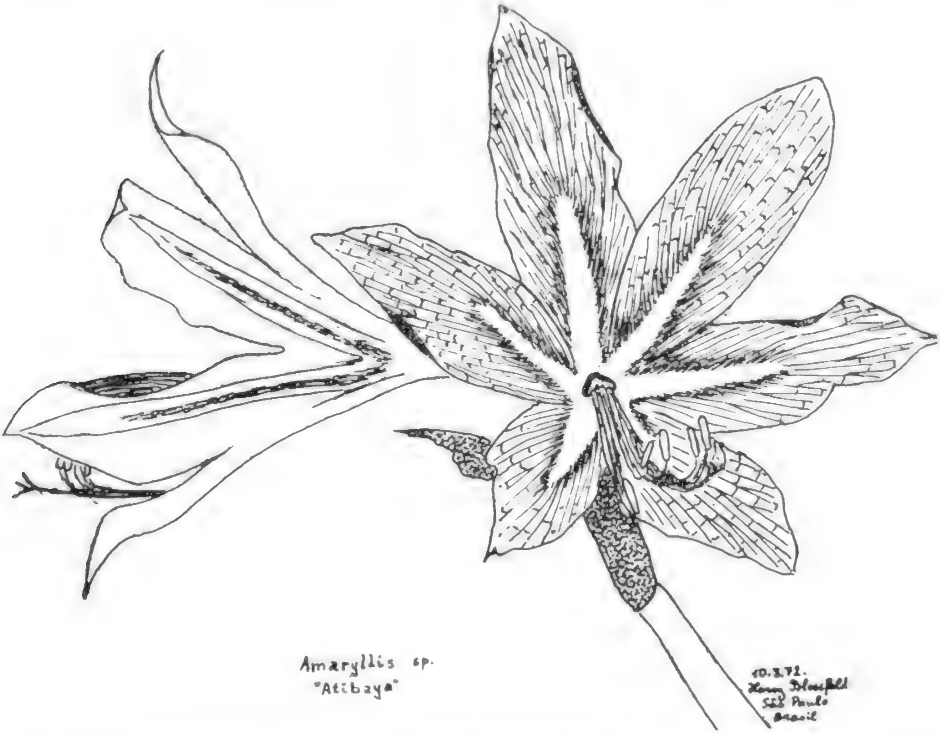

Fig. 3. **Amaryllis** species, from Pedra Grande near Atibaia, Brasil. See text for further comments. From drawing by Harry Blossfeld

Comments: Herbarium material and living plants of this species were gathered by the late botanist F. C. Hoehne before 1946, who registered it in his book "O Jardim Botanico de São Paulo" at page 314, stating the type locality as Pedra Grande near Atibaya, classifying it by the synonym, "Hippeastrum ambiguum Herb."

In his "The Amaryllis Manual" (1958) Dr. Traub includes *Hippeastrum ambiguum* var. *tweedianum* Herb. as a synonym of *Amaryllis vittata* var. *tweediana* (Herb.) Traub, and indicates its "range Central Brazil, Collected by Tweedie, specimen (type) in the Hooker Herbarium,

according to Herbert (1837)". Traub believes this plant to be identical with a plant collected by Nelson at Santa Cruz, Bolivia.

A study of the life and travels of Tweedie, apparently the discoverer of the plant, reveals, that this collector emigrated in 1825 to Argentina, where he worked as a landscape architect in the province of Buenos Aires. He started as a plant collector in 1832, when the British minister residing in Rio de Janeiro contracted him as travel companion on his way from Buenos Aires to Rio. Both collected about 1000 herbarium specimens on this route, which started by the river Uruguay and continued on horseback through southern Brazil. On their way they must have touched São Paulo and most probably passed through Atibaya, the traditional first rest-place of travelers to Rio de Janeiro. It is very probable that they gathered this *Amaryllis* species there.

Tweedie returned from Rio de Janeiro to Buenos Aires by ship and 1835, traveled westwards, reaching Tucuman but never beyond to Bolivia. In 1837 he again traveled from Buenos Aires to the south, reaching Mar del Plata. The identity of Herbert's *Hippeastrum ambiguum* var. *tweedieanum* with a species collected in Santa Cruz, Bolivia is, from this evidence, improbable, because the latter is 1000 kilometers distant from Tweedies most westernly locality (Tucuman) and 1800 kilometers from São Paulo and Atibaia, the latter stated by Hoehne as being "the classic locality of this species".

A comparison of my descriptive notes on the plants gathered at Atibaia with the original description by Herbert (which I do not have) and investigaton as to the herbarium material in the Hooker Herbarium may clear up this matter in the near future. A drawing of my plant is shown in Fig. 3. The plant is really a beautiful species. Its cultivation has offered no difficulty under sub-tropical climatic conditions, since the habitat is precisely on the division line between the tropics and temperate region, and at an altitude of 700 meters (2000 feet) above ocean level.

THE AMARYLLIS RESEARCH INSTITUTE, INC.,

respectfully requests your assistance in realizing our purposes of

1. Perpetuating species of the Genus *Amaryllis* by preserving viable breeding colonies of the various species,
2. Studying the breeding and physiology of these plant species, and
3. Supporting exploration in their native habitats for new species of *Amaryllis* and supplementing the breeding stocks of known species.

The Amaryllis Research Institute, Inc., is a not-for-profit corporation under the laws of the State of Indiana. It was founded to preserve, propagate, and study plants of the amaryllis family. Our chief activity is to establish an Amaryllis Germplasm Reservior to preserve in North America viable breeding colonies of threatened or potentially threatened species of the South American genus *Amaryllis*, Linnaeus (synonymous with *Hippeastrum*, Herbert). Among these species were the original wild ancestors of the familiar modern commercial hybrid amaryllis. Many were then lost to cultivation for over a hundred years—until recently rediscovered.

Your tax-deductible contribution will help the Institute to gather together living specimens of existing plants in North America and to begin breeding for fertile seed strains of each species that is available.

Scientific studies of the breeding and physiology of Amaryllis have been funded by a small starter grant from the Indiana Academy of Science. These funds, of course, can be used only for the limited purposes specified in the grant. It is the goal of the Institute to extend and continue these studies with funds contributed by the plant-loving members of the worlds of gardening and horticulture.

Eventually, it is hoped that the Institute will be able to support occasional collecting expeditions to bring seeds or bulbs back from South America to strengten and broaden the breeding program.

Annual memberships are offered with contibutions of $5.00. Members will receive the Annual Report of the Institute, as well as any occasional publications issued by the Institute. Members will also be eligible to participate in distributions of surplus seeds as these become available from the Institute's projects.

If support warrants, a list of members with addresses and special interests will be issued to members, and a "Beginner's Handbook of Botanical Amaryllis Culture" is under consideration.

Write to: Dr. James E. Shields, President, The Amaryllis Research Institute, Inc., P. O. Box 50121, Indianapolis, IN 46250.

THE AMARYLLIS GERMPLASM RESERVOIR

JAMES E. SHIELDS, *President*

The Amaryllis Research Institute, Inc.
P. O. Box 50121, Indianapolis, Indiana 46250

On May 4, 1978, the Amaryllis Research Institute was incorporated as a non-profit organization at Indianapolis, Indiana, to provide an administrative structure for the amaryllis germplasm preservation project.

It should be no surprise to readers of PLANT LIFE to see the need for a program to rescue the botanical species and varieties of the genus *Amaryllis* expressed in print. Many of these species are becoming rare in their native South American habitats due to human activities. Collecting expeditions have ended, at least for the time being; and it is difficult for North American botanists and horticulturists to establish useful contacts with their South American counterparts. Furthermore, many species are represented in North American collections by only a very few clones. It is almost certain that several species are known in cultivation from a single clone and its vegetative offspring.

The primary purpose of the Amaryllis Research Institute is to establish and maintain an Amaryllis germplasm collection in North America. Additional aims include research into the physiology and taxonomy of the amaryllids as well as the dissemination of knowledge of the plants of the Amaryllidaceae. The last-named goal might duplicate the efforts of the American Plant Life Society, but it is our firm intention that such duplication shall not occur.

At the moment, the germplasm collection has its physical home in the bench space of the small home greenhouses of three of the members of the board of directors of the ARI, in suburban Indianapolis. Its contents, as of the date of writing, are given in an appended article. One of the greenhouses serves as a quarantine station for holding virally-infected plants and those suspected of harboring viral infections. Each accession is given its own serial number and is tagged to distinguish it from the personally owned plants with which it shares greenhouse space. Each plant's history is recorded under the accession number in the research records of the Amaryllis Research Institute. Indiana and Federal tax laws require strict accountability for the assets of non-profit organizations, and we will be required by these regulations to rigorously maintain the integrity of the live plant materials of the Amaryllis Research Institute, as these will constitute its principle assets.

The concept of preserving Amaryllis species is not original with this writer; Russell H. Manning suggested it several years ago. J. L. Doran implied its necessity in numerous published accounts and private communications, as he described the disappearance of old *Amaryllis* habitats due to the expanding human populations in South America. Dr. Hamilton P. Traub added many of the finishing touches in a single brief letter to this writer. The idea has also occurred to many others interested in these plants.

Encouragement and moral support have come from all corners of the United States: Dr. Gordon H. Svoboda, of Indianapolis, Indiana; Drs. Richard Evans Schultes and Timothy Plowman, of the Botanical Museum of Harvard University; Harold F. Winters and Margot Williams, of the U.S.D.A. in Maryland; Dr. W. D. Bell, of Gainsville, Florida; Sterling S. Harshbarger, of Pasadena, California; Drs. Thomas W. Whitaker and Hamilton P. Traub, of La Jolla, California; J. L. Doran, of Burbank, California; and Russell H. Manning, of Spring Valley, Minnesota.

GERMPLASM RESERVOIR

The germplasm reservoir is so-named to indicate the dynamic nature of the concept on which it is based. Rather than a "static" collection of seeds stored far below freezing in a cryostat, it is intended to become a breeding colony for each of the species it may contain.

Several parental clones of each species selected for the Reservoir are being sought, so that a reasonable degree of genetic diversity within the species can be maintained. For there to be a "breeding colony" means producing fertile seeds, growing seedlings to maturity, and further breeding. However, whereas the hybridizer seeks to attain some ideal of flower or plant perfection, the goal of the Reservoir must be to preserve *all* the genetic forms possible from the wild stock. Someday, it could conceivably become necessary to re-introduce these species back into their original habitats, using our Reservoir as the source of plants. The Genus *Amaryllis* may be suffering extirpation from their native habitats at present, but it is unthinkable that the indifference to the fate of these magnificent South American wildflowers could persist in their homelands.

SCIENTIFIC IMPLICATIONS

Physiology of Self-Sterility. It is highly likely that several species of *Amaryllis* will be available only as a single clone. Most species are also apparently self-incompatible; i.e., they will not produce viable seeds from their own pollen. The possible mechanisms of this are discussed by Heslop-Harrison (1975). It probably involves biochemical interactions between the pollen grains and the surface membranes of the stigma, or between the pollen-tube membranes and the membranes lining the channels of the style. It may be possible to overcome this evolutionary device to allow selfing of single clones in the laboratory. After two or three generations of this biochemical manipulation, it may be possible to find strains of seedling-grown plants which can produce fertile seeds naturally on crossing. This is clearly less desirable than breeding directly from a fairly large pool of diverse parental clones, but it may offer some advantages over straight vegetative propagation. This latter method will, of course, be kept as a last resort to preserve a plant species and propagate it.

The process of overcoming self-incompatibility will almost certainly yield seed-pods with few viable seeds and little likelihood of maturing and ripening normally on the scape. Fortunately, Dr. Bell has developed and published methods of embryo culture *in vitro* which will enable us to overcome this obstacle readily (Bell, 1972).

It is also possible that we may be compelled to resort to meristem propagation *in vitro* in cases of virus-infected clones or of single-clone accessions which cannot be forced to set seed by their own pollen. The methods of tissue culture propagation of *Amaryllis* described by Nowicki and O'Rourke (1974) and by Bell (1973) will give us a sound starting-point for such work, should it become necessary.

Taxonomy and Genetics. The cultivation of numerous independent collections of purportedly conspecific plants in the same greenhouse will offer some unusual opportunities for taxonomic studies based on plant habit and gross morphology. As F1 and F2 generations of seedlings from these parental clones mature, further insights into relationships will become possible. If methods are indeed found for generally overcoming self-sterility barriers, F1 seedling plants from selfed parental clones will reveal the breadth of genetic variability inherent in the individual clones. This will provide yet another system in which to increase our knowledge of the taxonomic interrelations of the various populations of the genus *Amaryllis.*

Mechanisms of Genetic Isolation Among Sympatric Populations. This is an area of botanical research in which the most formidable obstacles stand between the intentions and hopes of the founders of the Amaryllis Research Institute and their realizations. For only by supporting trained botanists in the field can it be hoped to succeed in the final resolutions of the perplexities of amaryllis speciation. The following list is not intended to be more than a preliminary suggestion of the types of phenomena that the evolutionary biologist must study directly in the habitats of the species in question:

I. *Pollination-vector isolation.* This is a well-known process in the

Orchidaceae, and has been extended to other types of plants and vectors in a recent paper by Sussman and Raven (1978). For instance, moths are nocturnal and prefer white flowers; fragrance also presumably plays a role in the interaction between nocturnal lepidopterid pollination vectors (i.e., moths) and the plants which depend upon them. On the other hand, hummingbirds are diurnal pollinators, and are strongly attracted to the color red; they are also apparently indifferent to fragrance. Bees are diurnal and partial to almost any bright colors. Bats are nocturnal and nearly indifferent to color while reacting strongly to fragrance.

II. *Temporal Isolation.* By having different blooming seasons, two populations can remain totally isolated from one another genetically while growing literally side-by-side. Even so subtle a temporal segregation as having their stigmas receptive to pollunation at different times of day or night could provide this isolation between plants blooming together at the same seasons.

It is possible to postulate mechanisms of genetic isolation among sympatric populations that could be investigated in an institution such as the Amaryllis Research Institution aims toward becoming. Two such areas of scientific research might be the following:

A. *Chromosomal isolation.* If two species of amaryllid, each having the same chromosome number (i.e., two diploids with 22 each) proved to be impossible to cross, the reason might well lie in an inability of their chromosomes to pair correctly at meiosis, leading to inviable aneuploid gamitic structures (Bell, personal communication).

B. *Physiological Incompatibility.* An apparently undemonstrated hypothesis (Heslop-Harrison, 1975) which could involve a parallel mechanism to the self-incompatibility mentioned above, but involving a marker-receptor system for recognizing and rejecting "foreign" (i.e., non-conspecific) pollen. This system could arise by a suitable gene-doubling and mutation within what was originally a single interbreeding population. I personally find this a tantalizing concept.

A PERSONAL NOTE

An explanation of the necessity for founding an independent corporate entity at this particular time, the Amaryllis Research Institute, requires delving into the founder's (this writer's) personal situation. I am a salaried employee of Eli Lilly and Company, with the position of a senior scientist in the biochemical research department. My salary is comfortable, but my financial resources are limited; in any case, I have a wife and a growing daughter to support. The considerable indulgence of my wife, Irma, has allowed me to crowd our present home with extensive beds of daylilies and a home-made 8 ft X 10 ft greenhouse. Our typical suburban half-acre lot has little room left to turn the lawnmower around in. The greenhouse is the principle abode of the Amaryllis Germplasm Reservoir and my remaining personal collection of *Amaryllis* species and hybrids. We find ourselves forced to acquire more living and gardening space; hence, the recent purchase of 5 acres of beautiful cornfield a few miles farther out of Indianapolis. On this land, we are

going to build a new home and an attached greenhouse of as large a size as our financial resources will allow. By the time you read this in print, the home and greenhouse will be nearing completion if all goes as planned. That greenhouse is the primary hope of a home for the Amaryllis Germplasm Reservior for the foreseeable future. An attempt to affiliate it with an established botanical garden failed, due to their own financial limitations. The tax laws in this country are not overly generous in dealing with hobbies as such. My only recourse-aside from abandoning the idea of rescuing botanical *Amaryllis* species and varieties entirely—lay in creating a tax-sheltered organization and attracting the support of others in the world of plant lovers. A quirk of the tax laws also forces us to seek as large a number as possible of individual, private contributors of modest sums: to qualify as a "Public Charity" (i.e., one eligible to receive grants from Foundations, etc) a minimum of ⅓ of our organization's income must come from these modest donations from the general public.

You, the members of the American Plant Life Society, are part of that "general public" and the most reasonable prospects for such support. BUT IT WOULD BE THE EXTREME OF FUTILITY WERE ANY OF YOU TO DROP YOUR AFFILIATION WITH AND SUPPORT OF THE AMERICAN PLANT LIFE SOCIETY IN ORDER TO SUPPORT THE AMARYLLIS RESEARCH INSTITUTE! Any weakening of the APLS would only undermine the aims and purposes of the ARI. We sincerely request the aid of those of you sympathetic to our project, but *not* if it means choosing between the APLS and the ARI.

Contributions of live plant materials to the Amaryllis Germplasm Reservoir are most welcome, where the species are available as offsets or as seeds. Hybrids should not be donated without prior consultation: and it is especially important that virus-carrying plants be clearly so marked and kept segregated from uninfected plants.

ORGANIZATION OF THE AMARYLLIS RESEARCH INSTITUTE

As a Not-for-Profit corporation under Indiana law, there must be a Board of Directors of at least three members, and at least two officers, both of whom may or may not be members of the board. The Board of Directors of the ARI is made up of the following five individuals: James E. Shields, Ph.D., President and Member of the Board, Research Scientist; Eli Lilly & Co., Indianapolis, Indiana; Bruce H. Frank, Ph.D., Research Associate, Eli Lilly & Co., Indianapolis, Indiana; Charles R. Epperson, D.D.S., 1619 W. 86th St., Indianapolis, Indiana; Calvin E. Higgens, Research Scientist, Eli Lilly & Co., Indianapolis, Indiana; and Klaus K. Schmiegel, Ph.D., Senior Organic Chemist, Eli Lilly and Co., Indianapolis, Indiana.

The Secretary-Treasurer's office is currently held, somewhat reluctantly, by Mrs. Irma Shields, wife of the president. Legal niceties require that the Corporation hold at least one meeting each year of the Board of Directors at which a majority of the members are present. For this reason, and a total lack of travel funds, the Board members

were chosen from the founder's circle of friends in the Indianapolis area. Mr. Higgens and Dr. Schmiegel are experienced home greenhouse operators; Dr. Frank has had wide experience on the boards of community service organizations; Dr. Epperson has the experience of maintaining his own professional corporate organization.

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SPECIES AND HYBRIDS OF AMARYLLIS IN THE GERMPLASM RESERVOIR

The following list covers the types of plants represented in the Amaryllis Germplasm Reservoir as of approximately July, 1978. Many are gifts to the Amaryllis Research Institute, while others, in particular some rare and very valuable plants, are on loan to the ARI for use in breeding. Loaned plants and their vegetative propagations must be returned to the lenders on demand.

AMARYLLIS SPECIES	NUMBER OF CLONES	COMMENTS
aglaiae	3 sibs	unbloomed seedlings
anzaldoi	1	virus suspected
argentina	1	
aulica	many	
belladonna	many	
belladonna semiplena	1	
belladonna #E16-1	1	
blossfeldiae	many sibs	small seedlings
blumenavia	1	
calyptrata	1	
evansiae	many	
fosteri	4 to 6 sibs	unbloomed seedlings
fusca	1	
fragrantissima	1	
flammigera	2	
"leopoldii" #A17	1	one virused plant and one uninfected offset
mandonii	1	
moreliana	1	
neoleopoldii	3	unbloomed seedlings
papilio	1	
parodii	5 sibs	small seedlings
psittacina	1	
petiolata	2 ?	one pot is virused
reginae	1	
reticulata	2	
stylosa	1	virus infected
tucumana	1	
PI390628, -629, -630	3 ?	
Cheese & Watson 5038	1	
Cheese and Watson 5217	1	
Doran #1278	1	
Doran #1323	1	
Doran #1525	1	

The following hybrids are held in the ARI collection only until parental clones of their species parents can be obtained:

aulica x **forgetii**
correiensis x **fosteri**
evansiae x **reticulata** x **braziliana**
lapacensis x **nelsonii**
traubii doraniana x **aulica stenopetala**
(E16-1) x **traubii doraniana**

PRESENTATION OF THE 1978 HERBERT MEDAL TO DR. WALTER S. FLORY, JR.

In behalf of the Board of Directors of the AMERICAN PLANT LIFE SOCIETY, Provost Edwin G. Wilson, WAKE FOREST UNIVERSITY, Winston-Salem, North Carolina, presented the 1978 WILLIAM HERBERT MEDAL, awarded for outstanding contributions in the field of the *Amaryllidaceae*, particularly in thefield of caryology (chromosomes), and evolution of species, to Dr. Walter S. Flory, Jr., at the WAKE FOREST UNIVERSITY CONVOCATION, at Winston-Salem, North Carolina, in Wait Chapel, on September 5, 1978.

THE EDITOR'S MAIL BAG

Dr. Robert Smirnow, Route #1, Huntington, N. Y. 11743, of the firm of Louis Smirnow (85 Linden Lane, Glen Head, P. O. Brookville, Long Island, N. Y.) who have done wonders in *Peony breeding* as shown in their booklet, "Tree Peonies", has become interested in *Lycoris* breeding. I do hope that Dr. Robert Smirnow can do for the fine Genus *Lycoris* what the Smirnows have accomplished with the Genus *Paeonia*.

With this issue we welcome Mr. James Elsol of Queensland, Australia, as a member of the Society, who has been asked to furnish an Australian Newsletter for each issue.

Mrs. Nell Keown, of Mobile, Alabama, writes, under date of July 12, 1978, "We had word that Mrs. Boshoff-Mostert of South Africa, will be visiting the United States in September. She leaves South Africa on September 3, going to Rio, Brasil, Miami, Orlando, and will be in Mobile September 26th through 30th. It seems her husband died in 1976, and she had to dispose of everything except her Hemerocallis, which are her main interest now. She offered to speak at our Hemerocallis Club while here. Arrangements are being made. I sent to Germany for the Traub-AMARYLLIS MANUAL as soon as I read about it in PLANT LIFE, but they had already sold out."

We are saddened to report the death of Mulford B. Foster, the Dean of the Bromeliadarians, and Amaryllid enthusiast, and 1951 WILLIAM HERBERT MEDALIST, at the age of 89 years, August 28, 1978, after 4½ years of paralysis; organically he was in excellent condition.

The Editor enjoyed a visit from Hubert C. Monmonier, 2305 Bella Vista Drive, Vista, Calif. 92083, on Tuesday, December 12, 1978. He is an outstanding amateur grower of Cactus and other succulents, and Amaryllids.

John Bond reports on *Agapanthus* Trials, from Wisley, in The Garden (Jour. Roy. Hort Soc.) Vol. 103(8): 315-318. Aug. 1978, in-

cluding many awards made for outstanding blue-, and white-flowering selections. The clone, 'Loch Hope' (Savill), dark blue flowers, extends the flowering season to late September and even into October. It is 3 feet in height.

The members should note the change in address of Mrs. Emma D. Menninger, *from* 1030 Old Ranch Road, Arcadia, Calif. 91006 *to* 546813 Paseo del Lago East, Laguna Hills, Calif. 92653.

1. REGIONAL ACTIVITY AND EXHIBITIONS

1978 AMARYLLIS SHOW SEASON

The 1978 Amaryllis Show season began early on April 1st with the Sixth Intra-Club All Horticulture Amaryllis Show, in New Orleans, and in Texas with the Corpus Christi Amaryllis Show, on the same date. However, The Greater Houston (Texas) Amaryllis Club Show, scheduled for April 2, could not be held due to earlier severe winter weather that delayed blooming of Amaryllis generally. The New Orleans Official All-Horticulture Amaryllis Show was held on April 8, but the Houston (Texas) Amaryllis Society Show, announced for April 9th had to be canceled due to previous inclement winter weather. The Southern California Official Amaryllis Show was held on April 22nd and 23rd; and the Mobile (Alabama) Greater Gulf Coast Amaryllis Society Show took place on May 6th and 7th. The Show season ended with the 1978 Extravaganza which was held at the Los Angeles State and County Arboretum at Arcadia, California, June 10th and 11th.

NOTE TO AMARYLLIS SHOW ORGANIZERS

It is important to designate some one to write a *brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub, Editor. Amaryllis Year Book, 2678 Prestwick Court, La Jolla, Calif. 92037. *Your plans are not complete until this appointment has been made.* Only in this way is a permanent international record of your show assured.

1978 NEW ORLEANS INTRA-CLUB SHOW

L. W. Mazzeno, Jr.

944 Beverly Garden Drive, Metairie, La. 70002

The sixth annual Intra-Club all horticulture Amaryllis Show was staged by the Men's Amaryllis Club of New Orleans on April 1, 1978 in the City Park Backer Room. Awards were won by T. A. Calamari, Jr., for the best 4-floret specimen "Summertime"; Holly H. Bowers, Jr. for the best 3-floret specimen "Candy Floss"; and the author of this article for the best 2-floret specimen "Alvira Aramayo".

The Club's regular annual Show, open to the public, was held April 8, 1978, and is reported separately.

1978 CORPUS CHRISTI AMARYLLIS SHOW

MRS. CARL C. HENNY, *Corresponding Secretary,*
P. O. Box 3054, Corpus Christi, Texas 78404

Texas suffered a very cold winter this year with only a small amount of rain to fall in Corpus Christi during the first part of January. This naturally caused our ground to remain cold and dry—which also caused slow development of all of our horticulture. Therefore, on April 1st, our Amaryllis Society Exhibit consisted of only 10 entries to be judged and 2 entries for display, much to our disappointment. Nine of these entries were potted specimens. Only one cut specimen was available for display. If our Annual Flower Show had been held two weeks later we would have had a much better exhibit. However, none of us can control the weather or the bloom period of our flowers.

Mr. and Mrs. Bill Miller, club members, received the Silver Bowl Award for their entry of 'Beautiful Lady'. Mr. J. M. Mabe, club member, received blue ribbon awards for his entry of 'Beautiful Lady' and "Summer Time".

Other registered and named potted amaryllis entered in the Exhibit were: 'Amethyst' (Van Muean), 'Palace Sunset,' 'Ludwig's Goliath,' 'Doris Lillian,' 'Desert Dawn,' 'Cinderella,' and 'Fairyland.'

National Accredited Judges for the Exhibit were Mrs. G. Browning Smith of Harlingen, Texas; Mrs. Tom Burke, Jr. and Mrs. Jesse Jamison, Jr. of Corpus Christi, Texas.

THE GREATER HOUSTON AMARYLLIS CLUB

MRS. SALLY FOX, *Corresponding Secretary*
1527 Castle Court, Houston, Texas 77006

The reserved date of April 2, 1978 for the Greater Houston Amaryllis Club's annual official Amaryllis Show was too early this year due to severe Winter weather. There were no blooms; in fact, most bulbs and plants in this area were just about one month late in blooming. Our final meeting and installation of officers is held the first Monday in May, which was the 1st. As a rule our long banquet table is centered with choice daylily blossoms from each member's garden. This year only three daylily blossoms were brought in on that date, but the table was loaded with Amaryllis blooms—which made us all feel we were having a delayed show. Our only wish was that the public could have been able to view this magnificant display of show quality Amaryllis blooms. Hopefully, next Spring we can carry on our pledge of 'promoting interest in growing amaryllis'.

1978 GREATER NEW ORLEANS OFFICIAL ALL-HORTICULTURE AMARYLLIS SHOW

L. W. MAZZENO, JR.
944 Beverly Garden Drive, Metairie, La. 70002

On April 8, 1978 the Men's Amaryllis Club of New Orleans, Inc.

held its nineteenth annual all-horticulture Amaryllis Show.

For those who thought the 1976-77 winter in New Orleans was severe, they were in for a double shock in 1977-78. The prolonged cold weather took its toll again in the number of entries for the Show. Most affected were, quite naturally, the specimens grown outdoors. Total entries were only 157, the lowest ever for this Show. Despite this, the display was beautiful and the quality of exhibits high.

The number of trophies awarded each year keeps growing. A new one was introduced honoring Milo C. Virgin, for many years the mainstay of the annual Show. Until his illness, it was always expected that come rain or shine, warm or freezing weather, Milo would have about 50 or more entries. To us, in the Club, he will always be "Mr. Amaryllis". So, it was only fitting that an award be introduced in his honor. The trophy was awarded for the best specimen in the Show as judged by the total membership of the Club. It went to Holly H. Bowers, Jr.

In the official judging, by the Show judges, Mr. A. T. Diermayer won the "Best-in-Show" Rosette and the Holly H. Bowers, Jr. Trophy for the best specimen in the Show. To most it was an unexpected but delightful surprise that the judges chose a species *Amaryllis - Evansiae* - for this award. It certainly was well deserved because the specimen was spectacular. In addition to his "Best-in-Show Awards," Mr. Diermayer was also awarded the James E. Mahan Award for the best named and registered hybrid, the Ludwig Challenge Cup and the accompanying MACNO Club Trophy, the Edward F. Authement Award for runner-up to the best unnamed, unregistered hybrid, the Amaryllis, Inc. Award for the best Amaryllis species, the Nola Luckett Trophy for the best 2-floret potted specimen and the Sweepstakes Ribbon for most blue ribbons in the unregistered specimens.

Contining his success of previous years, Holly H. Bowers, Jr. won the most awards of any competitor in the Show. Besides the Milo C. Virgin Award, he also captured the W. J. Perrin Memorial Award for runner-up to the best named and registered hybrid, the Laurence Mazzeno Trophy for the best miniature hybrid, the T. A. C. Construction Co. Award for the best unnamed and unregistered specimen, the Reuter Seed Company, Inc. Award for best cut flower, the George Merz, Jr. Trophy for most blue ribbons won by a Club member, the Sweepstakes Ribbon for most blue ribbons in the registered specimen Sections, and best of all the most sought after Robert Diermayer Memorial Award for best hybrid in the Breeder's Class.

Other trophies were won by: Ed M. Beckham, the Vincent Peuler Award for best registered single floret; L. W. Mazzeno, Jr., the Jerome Peuler Award for best unnamed single floret; L. L. Laine, the Gautier Family Trophy (first year awarded) for best registered 2-floret potted specimen; O. J. Robert, Sr., the Victor Pannell Trophy for runner-up to the best registered 2-floret potted specimen.

Other Club members winning blue ribbons were: T. A. Calamari, Jr., and Vincent J. Peuler.

Vincent J. Peuler served as Show Chairman, ably assisted by Albert Touzet, Jr. Their guidance and hard work assured the success

of the Show. Almost every member served in some capacity prior to and during the Show. Much thanks goes to them. We must single out A. T. Diermayer. Without his tremendous effort in arranging for the location and the widespread publicity, including appearances of some of our members on two television shows, the Show could not have been held. His untiring work year after year are most appreciated by the entire Club.

Next we must thank the merchants of the Lakeside Shopping Center for making their beautiful Mall available to us for the Show.

The judges, what can we add to what's been said before. These ladies give unselfishly of their time every year for the benefit of the Show. Their contribution is really appreciated.

And to the doners of the trophies, again thanks. The new Orleans Show is rather unique, we think, because none of our awards are rotating awards. (The Ludwig Challenge Cup was, but it was retired this year.) The winner of each award keeps it. And every year it means a new trophy from each donor. Our grateful appreciation goes to them.

HOUSTON AMARYLLIS SOCIETY

MRS. A. C. PICKARD, *Official Show Chairman*

1909 Alta Vista, Alvin, Texas 77511

The Houston Amaryllis Society's Show, announced for April 9, 1978, was cancelled due to earlier inclement weather. The prolonged cold winter seemed to delay the blooming period and the result was poorly developed scapes and very poor quality of blooms. The Society depends a great deal on garden grown blooms for its shows.

We are planning the 1979 April Show hoping old man weather will give us an early Spring. Our goal as usual is to keep the unity or continuity of growing, showing and sharing as we have the past twenty years.

1978 SOUTHERN CALIFORNIA OFFICIAL AMARYLLIS SHOW

V. R. FESMIRE AND S. HARSHBARGER, *Co-chairmen*

The 1978 Amaryllis Show was held as usual at the Los Angeles Arboretum in Arcadia on April 22nd and 23rd. Since there had been a very rainy winter with a late Spring, it was decided to set up the tables for a small show, but to everyone's surprise, more and more flowers arrived, and we ended up with a very large flower show. There were a total of 14 exhibitors with 114 entries, plus five special exhibits and much background material.

Unfortunately, there were very few entries of named and registered Amaryllis, and none scored 95 points or higher. The bulk of the flowers entered were in the Hybridizers Section, and here the competition was extremely close. There were entries in Divisions 3, 4, 5, 7, 8, and 9, and

these beautiful flowers were the backbone of the Show, as can be seen in Figure 4. Particular mention should be made of the Belladonna hybrids, both potted plants and cut scapes, entered in Division 3. This group was probably the largest showing we have ever had of Belladonna hybrids, and it was one of these which won the Quinn Buck award as the best seedling in the Show. This was a beautiful plant with four rather large flowers of lavender and white, being a cross between *A. evansiae* and *A. brasiliana,* and entered by D. C. Cothran. This hybrid, incidentally, was just one of many beautiful hybrids that Mr. Cothran has been producing by his program of species crossing.

Fig. 4. Partial view of the Amaryllis exhibits at the 1978 Southern California Amaryllis Show, Arcadia, California. Photo by Phil Rosoff

The Sweepstakes Award was won by Ed Pencall, who entered a large number of his beautiful seedlings in Divisions 5, 8, and 9; the runner-up was D. C. Cothran. The Judges' Award, for the best flower in the Show from their viewpoint, was given to Leonard Doran for his entry of 'Elenora', the judges being Gladys Williams, Fred Boutin, Joe Werling, and Roger Fesmire. The President's Award, given to the winner of the Popularity Contest, went to D. C. Cothran for another of his seedlings; the visitors to the Show selected this magnificent apricot hybrid by an overwhelming majority. Special awards were also made to Fred Boutin's educational exhibit, and to Mr. E. Mathis for furnishing the *Amaryllis* flowers used in arrangements and as background color, and to three other special exhibits.

These three special exhibits became major attractions at the Show. The first of these, shown in Figure 5, was an exhibit of *Amaryllis* species by Leonard Doran, featuring seven different species in bloom, one of which is still not named, plus colored photographs of many other species. It is doubtful if such an exhibit, with seven species in bloom at the same time, has ever before been seen in this country, and Society members and visitors alike were much impressed by the sight. The second special exhibit was one of the other members of the *Amaryllis* Family; part of this can be seen on the right side of Figure 5. Sixteen different genera

Fig. 5. Southern California Amaryllis Show, 1978. **Upper,** Partial view of flower arrangements. **Lower, Amaryllis** species exhibits by L. Doran. Photos by Phil Rosoff

were represented, plus several doubtful ones. Some were in bloom, but many were not, although the plants were all clearly labeled. The discussion carried on at these two tables showed that the public is very much interested in Amaryllids. The third exhibit consisted of several tables of flower arrangements, each centering around the Amaryllis flower. These were made by the ladies in the Amaryllis Society under the supervision of Alice Hanson, and a small portion of them can be seen in Figure 5. These arrangements displayed much ingenuity and good taste, and were a definite attraction to the ladies visiting the Flower Show.

THE AMARYLLIS SOCIETY OF MOBILE

MRS. NELL KEOWN,

2210 Pratt Drive, Mobile, Al. 36605

The Amaryllis Society Of Mobile held its annual Greater Gulf Coast Amaryllis Show on May 6th and 7th, 1978 at the Bel Air Mall Mobile, Alabama.

The date for the show was originally set for April 22nd and 23rd but due to prolonged cold weather it was rescheduled for the later date.

Two days before show time we had a drenching six inch rain. But with two beautiful days of sunshine we were able to have a show that was smaller than usual, but still a good one.

Our show is open to the public and everyone is encouraged to enter flowers whether a member or not.

Mr. John Fellers, a non-member, won the John A. Lamey Memorial Trophy for the most outstanding horticultural potted specimen in the show with 'Elvira Aramayo.'

Mrs. Nell Keown won a silver trophy for Sweepstakes and one for a beautiful candy stripe type seedling. She also won three trophies for the most blue ribbons in three different catagories.

Mrs. C. E. Tagert won the Ludwig Trophy for an outstanding 'Apple Blossom' and two Amaryllis Society Of Mobile Trophies for the most blue ribbons in two different catagories.

Mrs. Mammie Wiggins won the Amaryllis Society Of Mobile Trophy for a cut specimen of an American hybrid. She also was awarded the Inez Scheuermann Trophy for the most blue ribbons in the American potted and cut division.

Many blue ribbons were awarded, some receiving them were, 'Golden Triumphator,' 'Snow Queen,' 'Orange Wonder,' 'Moreno,' 'Prince of Orange' and 'Bordeaux.'

One feature that drew special attention this year was a table of single florets displayed in orchid picks. For this display Mrs. Tagert and Mrs. Keown were awarded special rosettes.

Different types of plants were donated by the members and we had a successful plant sale that helped finance the show.

Despite a few anxious days and nights the show turned out to be a real success, even though it was a full three weeks later than usual.

We're looking forward to a more favorable *Amaryllis* season next year which will be our 25th show.

Mrs. Mammie Wiggins was club president. Mr. Freddie Frambrough, Jr. was show chairman.

1978 SPRING EXTRAVAGANZA

Chaired by GLADYS WILLIAMS, and reported by DICK SLOAN

Each year the Los Angeles State and County Arboretum, at Arcadia, has a well advertised Extravaganza weekend, when the various local plant societies advertise themselves, answer questions, stage displays, provide demonstrations, and, with the Arboretum, present programs for sessions scheduled throughout the weekend.

The Southern California Hemerocallis and Amaryllis Society participated again in this year's event on June 10th & 11th, held under gauze canopies on the Arboretum lawns. We were fortunate that the schedule was timed perfectly for our local peak daylily bloom. Literally hundreds of individually labeled blooms were displayed, a fantastic mass of color. In addition, blooming potted plants of some of the new superstars such as 'Agape Love' and 'Rosette' were shown by Bob Shufeldt, to indicate to the many interested visitors how a modern daylily looks as a whole plant. The color range of the newer hybrids created a sensation. We were besieged by source inquiries and gained 22 members for our local society.

Many of our own members took the opportunity to note blooms for their own personal want lists. I can scarcely have made more clear my desire to grow a particular seedling of Bill Hawkinson's WHENEVER A SPARE IS AVAILABLE!!!

On the Sunday afternoon Bob Shufeldt, a member, presented a superb history, culture, demonstration, question and answer lecture-discussion on our flower. Many good questions indicated the interest he created.

This event provided our local gardeners with a clear view of modern daylilies by example and by information. We noted a number of those who visited our booth came again to enjoy our successful show staged two weeks later at the Arboretum lecture hall.

THE AMERICAN AMARYLLIS SOCIETY STUDY COURSE FOR THE AMARYLLIS JUDGE'S CERTIFICATE

MRS. A. C. PICKARD, *Official Judging Instructor,*

1909 Alta Vista, Alvin, Texas 77511

Amaryllidaceae (Am-ah-ril-i-day see-ee), the Amaryllis family, contains over seventy genera and hundreds of species of mostly tropical plants. Lily-like florets are different from the Lily family in the technical character of the superior ovary. The Amaryllis family contains many garden favorites of perennial herbs growing from bulbs, rhizomes or fibrous roots.

The genus *Amaryllis* is one of the many genera in the Family Am-

aryllidaceae which contains species that bear several showy florets on a single leafless scape. By extensive hybridizing, bulbs of these hybrids may be considered a cultural group produced in enormous quantities in our states. The blossoms are of various sizes - from miniatures to giant.

The color spectrums range from a choice of pure white, rose pink, salmon, orange, blends and stripes. Red colors range from scarlet, orange red, blood red, dark red and varigations.

Amaryllis is the classical name given the plant by Linnaeus, the master plant recorder and botanist. The word is derived from the Greek word 'Amarysso', meaning "to sparkle" and refers to the surface texture of the blossom.

The name, 'Belladonna', is the Italian for 'beautiful lady'. Linnaeus finally adopted the name *Belladonna* in combination with his new generic name, *Amaryllis*. For more than 250 years various forms of *Amaryllis belladonna* have been in cultivation and crossed with other species and this has opened up a great field for the plantsman. The common form of *Amaryllis belladonna* is grown in Florida, known as "Florida Red," and is botanically referred to as *A. belladonna* var. *major*.

The American Amaryllis Society has classified cultivated *Amaryllis* in nine Divisions on the basis of the chief characteristics of each group. Further sub-division may be made within each of the nine divisions. Each division contains many varieties. This form of classification is necessary as the foundation for exhibition schedules and as the basis for grouping by *Amaryllis* breeders. Familiarity with the flower and its parts is necessary to intelligent evaluation.

In order to simplify the classification, the nine divisions of cultivated *Amaryllis* have been arranged in numerical order with a brief description of the distinguishing characters of each.

Division 1. (D-1), includes all the cultivated wild *Amaryllis* species, sub-species, varieties and forms. The majority of species are native to Boliva, Brazil and Peru. Example: *A. striata* var. *fulgida*.

Division 2. Long-Trumpet (D-2). The whole flower is very long and trumpet shaped, similar to the Easter Lily. The pedicels are relatively long and the flowers are distinctly drooping. The tepaltube is very long, 4½ to 5½ inches. Example: *A. elegans* var. *ambigua*,—color of flowers varies from pure white to white, striped with pink lines.

Division 3. Belladonna type hybrids. (D-3). The flowers are much shorter than in Division 2 and gracefully drooping. The pedicels are long and the tepaltube less than 4 inches in length. They show the influence of species with the informal flower structure of *Amaryllis belladonna*, *Amaryllis vittata* and others. Example: (a) *A. johnsonii*; (b) 'Christmas Joy'.

Division 4. Reginae type hybrids (D-4). The pedicels are shorter than in Division 2 and 3. The tepaltube less than 2 inches in length. The flowers are slightly drooping, horizontal or slightly upright and are moderately open faced. When viewed sideways, the flower length exceeds 4 inches. The tips are rounded or slightly pointed. There are

two sub-divisions in Reginae. D-4A- markedly imbricated type. The tepalsegs overlap ¾ or more of their length. Tips of segs are rounded or slightly pointed. Example: 'Helsenki'. (V.M.) and 'Summer Time', Hadeco. D-4B—This is the less imbricated type. The tepalsegs overlap less than ¾ of their length. The segs are sometimes reflexed. The tips are rounded or pointed. Example: 'Picotee' (Ludwig).

Division 5. Leopoldii type hybrids (D-5). The flowers are similar to those of Division 4 except the flowers are wide open flat form. When viewed sideways, the length must not exceed 4 inches. There are two sub-divisions in this division. D-5A- The tepalsegs are imbricated almost their entire length. The tips are rounded. Example: 'Boquet' (Ludwig) D-5B- The flowers are similar to D-5A except the segs are less imbricated. The tips are rounded or slightly pointed. Example: 'La Forest Morton' (Ludwig).

Division 6. Orchid flowering type. (D-6). The tepalsegs are not arranged according to the usual flower pattern. They are variously shaped, twisted or extremely reflexed, similar to *Sprekelia* (the Aztec Lily), *Amaryllis cybister, Amaryllis calyptrata,* and other irregular-shaped forms.

Division 7. Double hybrids (D-7). This division includes the semi-double and fully double forms of hybrids under culture. The flowers have two, three or more rows of segs, each seg narrowing and shortening toward the center of the flowers. There may be petaloid "ears" in the center. Example: 'Helen Hull'.

Division 8. Miniature type hybrids (D-8). Distinctly dwarf statured types, including various flower forms. The flowers harmonize with the smaller scape diameter and height. Example: Gracillis hybrids.

Division 9. Unclassified hybrids. (D-9). Meritorious hybrids that cannot be placed with certainty into any preceding Division.

The flower form and structure make up the chief difference between Reginae hybrid (D-4) and Leopoldii hybrid (D-5). The Reginae flower moderately open faced but not flat. The Leopoldii flower is a wide open flat form.

Familiarity with the Divisions of cultivated Amaryllis is necessary to intelligent evaluation.

A mature plant produces infloresecences and fruit.

A *clone* is the offspring reproduced by asexual methods (vegetative method of reproduction) of species and hybrids. An unnamed seedling refers to the seedling grown from a particular seed before there is any increase by vegetative means. The clone may be unnamed or named. After the unnamed clone receives a name and is registered, it is referred to as a named clone, such as 'Apple Blossom', 'Bouquet', etc.

Besides the essential reproductive organs, there are several accessory parts:

The infloresecence is the flower bearing transformed branch consisting of the scape, spathe valves, pedicels and the umbel of flowers (flower cluster).

A *scape* is a leafless stem that rises from the bulb (without foliage) which supports the umbel of flowers.

An *umbel* is a flower cluster of two or more flowers that arise from nearly the same point on top of the scape.

A *pedicel* is a stem of the single flower in a cluster. (The support or arm of the flower).

Spathe-valves are leaf like bracts enveloping the immature flower buds and protect them from injury before they open.

The six flower leaves or petals are *united below*, forming a short or longer *tepaltube* below, with free portions above, or *tepalsegs*, segs for short.

Tepalsegs are the six parted portions of the blossom. The three *outer* tepalsegs are setepalsegs (abbreviated to setsegs). These are usually broader than the three *inner* tepalsegs.

The inner three tepalsegs are called petepalsegs or petsegs for short.

Note.—Observe the difference in size of the tepalsegs as they make up the characteristic form of the flower.

Tepaloids are characteristic of some *Amaryllis* hybrids. Sometimes the tepalsegs are variously lobed or twisted near the center. They vary in width, shape and length. They are sometimes referred to as "ears".

Nectaries are glands for the production of nectar and fragrance, attracting insects and birds that transfer the pollen from the anthers to the stigma of the blosson.

The flower organs of reproduction are formed partly inside the *perigone*. The *stamens* are the male reproductive organs. These are composed of very small stems called *filaments*, which are topped by two lobed *anthers*. When mature, the lobes split lengthwise and expose the pollen grains necessary for pollination of the blossom.

The *pistil* is the female reproductive organ. It consists of the *ovary*, *style* and *stigma*. The *stigma* is the capitate or three-lobed structure that receives the pollen.

The ripened *ovary* and adhearing parts is the Amaryllis *fruit;* it is 3-loculed. with flat, black or brown seeds in each locule.

An Amaryllis *hybrid* is a plant resulting from a cross between parents unlike one another in one or more heritable characteristics.

Conformity to *Division standards* is of first importance in the placement of entries in Amaryllis shows. Amaryllis can be judged for flower structure and flowering habit by Division standards only.

Group entries in various colors, shapes and sizes make the show more interesting. There may be a collection, a minimum of 5 scapes all of the same variety; or 5 different types; or mixed colors.

Specialization is excellent for Flower Shows. Some think it is more spectacular and more exotic to feature *Amaryllis only* at an Amaryllis Show, while at other Shows sometimes *Clivia*, *Crinum*, *Eucharis*, *Nerine*, *Narcissus*, etc., are shown. These other Amaryllids may be included to give variety and information about the 85 genera and 1000 species in the large Amaryllidaceae family. To the general public, these just named are other kinds of flowers, because in shape, size, etc. there is only a

family resemblance to *Amaryllis*. With the exception of *Narcissus*, no detailed classification of the flower types of the other Amaryllids is available.

Anthers may be removed without penalty (if permission is granted by the show committee) in order to prevent pollen dusting over the segs. or for other prevailing reasons.

Amaryllis scapes grow tall and it is often necessary to stake them. If the stakes or ties are not conspicuous then no deduction in points is made.

1977 - SUPERCEDING ALL PREVIOUS SCORES

The ten rating characters that make up the scale of points in judging Amaryllis cut specimens and potted plants.

Character scored:	Method of Rating	Specimen Single	POTTED PLANTS Scape Single	Scapes 2 or more
1. Perfection of floret shape - (form)	Rating should be strictly within the division standard on the basis of beauty and form, which is true of a clone in all its customary variations. The normal shape at peak of maturity is judged on the individual floret and division.	20	20	20
2. Conformity to floret color standards.	True color is that which is characteristic for a given variety and judged entirely aside from one's personal preferences. Color qualities may respond favorably to cultural care, skillful handling of sunlight, shade, fertilizer and texture of the floret.	30	30	25
3. Floret size.	Since flower size is dependent on the division, the sizes recognized in the particular division concerned should govern.	15	15	15
4. Pose (symmetry of floret in umbel)	The contour should be generally symmetrical. The lower or bottom petepal (seg) is typically a bit narrow and a bit more elongated but must be in proportion for equal balance of all parts of the floret.	10	10	10
5. Length and character of scape.	The length of the scape should be considered in relation to the size of the umbel. The character of the scape means its weakness or	5	5	5

	strength to hold the umbel of flowers erect.			
6. **Number of florets per scacpe and number of expanded flowers (number of florets per scape includes unexpanded and expanded flowers)**	Only 3 or more flowers per scape are eligible. In large flowering hybrids, 2 flowers per scape are too few. Allow 3 points for this condition. Three flowers per scape is quite satisfactory - allow 5 points. For 4 flowers allow 6 points. (no addition points are allowed for more than 4 flowers.) In miniature type hybrids (Div. 8), the scape is usually quite slender and 2 or more flowered scapes are eligible; allow 4 points for 2 expanded florets, 6 points for 3 or more.	6	6	6
7. **Number of scapes per plant.**	This category applies only to potted plant exhibits. Allow 8 points for only one scape; allow 9 points for 2 scapes; 10 points for 3 or more scapes. Any scapes with faded blooms may have been removed without any deduction of points.			10
8. **Fragrance.**	If the judge can detect a pleasing fragrance this is a desirable trait and 2 points are added. Some species are recorded as slightly fragrant. If so, it is passed on in future generations. All blooms of plants produce nectar in attracting insects that transfer pollen to the stigma of the bloom, thus carrying out pollination in nature. All perfect hybrid Amaryllis are slightly fragrant. The Belladonna division has distinctive fragrance.	2	2	2
9. **Foliage.**	This category applies only to potted plant exhibits. Leaf growth that comes along with the flower scapes is very desirable and is often the result of culture and temperature control in a new bulb. The foliage usually appears before the blossom in established yard		2	2

	or pot grown Amaryllis. For well established foliage, allow 2 points. If foliage is entirely absent, deduct 2 points.			
10. Condition of exhibit.	Specimens in prime condition, properly cultured should receive the full number of points. Spent flowers or scapes should have been removed. The segs should be free of pollen stain or other soil. Evidence of insect injury must be severely penalized. Over-potted bulbs fall in this rating of points. Mechanical injury such as torn leaves or segs is penalized less severely. Staking is permissible if the stake is green, not too high and does not attract attention to itself. If the stake is conspicuous or out of proportion, a deduction must be made.	12	10	10
	Total possible score	100	100	100

OFFICIAL AMERICAN AMARYLLIS SOCIETY SHOW RULES

The official awards of the American Amaryllis Society may be presented at any Amaryllis Show or Amaryllis division of a general flower show which complies with the rules of the Society.

(1) All flowers exhibited are to be expanded in half or more direct light to show the typical flower color of the florets. Judging in all cases is on the basis of open blossoms and number of blossoms per scape. Never on the basis of the total number of blossoms of the potted plant.

(2) All exhibits must have been grown by the exhibitor. All plants in his possession less than one year should be classified and judged separately. All greenhouse grown plants should be classified and judged separately from yard grown plants.

(3) The Award of Merit is offered for the named and registered exhibit rating 95 or more. Second and third prizes may be offered in each division.

(4) In order to have only flowers in their prime condition, it is permissible to remove any scapes with fading flowers.

(5) It is very important to designate some one to write a *very brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub, Editor, Amaryllis Year Book, 2678 Prestwick Court, La Jolla, Calif. 92037. Your plans are not complete until this appointment is made. Only in this way is a permanent international record of the show assured.

In listing named clones, it is important to inclose the names in single quotation marks, thus: 'La Forest Morton', 'Maria Goretti', etc. Do not underline or put in all capitals.

The Amaryllis Judges Training Course concerns the Amaryllis plant, the wild and cultivated Amaryllis, the Divisions of cultivated Amaryllis, and the judging of Amaryllis specimens and potted plants at Amaryllis Shows.

The Amaryllis Judges Certificate indicates the applicant is qualified to judge in the Horticulture division of Amaryllis, as of the date issued.

KEEPING UP WITH LATEST DEVELOPMENTS

Current progress in the judging of Amaryllis is recorded in the Amaryllis Year Book. In order to insure that those holding Amaryllis Judge's Certificates keep up with these new developments, all certificates issued are valid only when presented with the current membership card of the American Plant Life Society which includes membership in the affiliated American Amaryllis Society. After several years a refresher course is recommended.

AMARYLLIS JUDGE'S CERTIFICATES

Since the last report in the 1978 Amaryllis Year Book (p. 45) the following numbered Amaryllis Judge's Certificates have been issued.:

No. 201. Troy Wright, 305 Bay Street, Texas City, Tex. 77590. Horticulture only. Mrs. A. C. Pickard, Instructor.

No. 202. Mrs. William Birch, 2607 Woodsdale, Houston, Tex. 77038. Horticulture only. Mrs. A. C. Pickard, Instructor.

No. 203. Mrs. Bertha Cone, 2711 Elysian, Houston, Tex. 77009. Horticulture only. Mrs. A. C. Pickard, Instructor.

PLANT LIFE LIBRARY—continued from page 124.

ages, (3) Artists, writers, musicians; (4) the Making of America; (5) Dinosaurs and Prehistoric Life, and (6) The Twentieth Century. With over 300 colorful illustrations in each booklet. These fascinating informative booklets are a very great bargain at the nominal price of $2.95 each and are highly recommended.

CACTUS LEXICON, by Curt Backeberg, enlarged by Walther Haage. The present translation was prepared by Lois Glass and based on the 3rd German Edition supervised by Walther Haage, who added nearly 300 additional recent species. Sterling Publishing Co., Two Park Av., New York City 10016. 1977. Pp. 828. Over 536 illus. Trade edition, $50.00; Library edition, $39.99.—The Preface to the First Edition by Curt Backeberg, 1965; a Foreword to the 3rd German Edition by Walther Haage, 1974, and Lois Glass' Translator's Introduction to the English Edition, 1977 (pages 6-8), precede short sections on "Principles of Systematic Classification," "Cultivation" (9-19), and "Classification:" Key to the Categories of the Family **Cactaceae**, subfamilies, Tribes and 233 genera (pages 21-59). The rest of the text is devoted to a **Descriptive Catalog** of the genera, species and varieties of the **Cactaceae** (pages 61-518); **Distribution Maps** (pages 519-544); 535 **illustrations,** 205 of these in color (pages 545-838); of these Nos. 1-459 are attributed to Backeberg, and Nos. 460-534 to others. Very highly recommended.

GREENHOUSE MANAGEMENT, by Joe J. Hanan, Winfred D. Holley and Kenneth L. Goldsberry. Springer-Verlag New York, 44 Hartz Way, Secaucus, N. J. 07094. 1978. Pp. 530. Illus. $67.00.—This outstanding new text greenhouse management breaks new ground since it charts the development of the industry and which is undergoing rapid technological change. The following named topics are explored thoroughly: light, greenhouse construction, temperature, water, soils and soil mixtures, nutrition, carbon dioxide and pollution, insect and disease control, chemical growth regulation, business management, and marketing. Appendicces and a subject index complete the volume. Very highly recommended.

Volume 30. PROGRESS IN BOTANY, by Heinz Ellenberg, Karl Esser, Hermann Schnepf and Hubert Ziegler. Springer-Verlag New York, 44 Hartz Way, Secaucus, N. J. 07094. 1977. This is a review volume of recent research in the fields of plant morphology, physiology genetics, taxonomy and geobotany since the publication of volume 29. Highly recommended.

NEW NATURAL PRODUCTS AND PLANT DRUGS WITH PHARMACOLOGICAL, BIOLOGICAL OR THERAPEUTICAL ACTIVITY, edited by H. Wagner and P. Wolff. Springer-Verlag New York, 44 Hartz Way, Secaucus, N. J. 07094. 1977. Pp. 286. Illus. $30.90.—This volume is devoted to the Proceedings of the First International Congress on Medical Plant Research, Section A, held at the University of Munich, Germany, Sept. 6-10, 1976. The subjects covered include: problems and prospects of discovering new drugs from higher plants by pharmacological screening; natural products screening and evaluation; data concerning antitumor and cytotoxic agents from plants; advances in the field of antibiotics; saponins with biological and pharmacological activity; investigations on Indian medicinal plants; dimeric natural compounds; and natural substances with effects on the liver. Highly recommended.

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2. LINEAGICS

[BIOEVOLUTION, DESCRIPTION, DETERMINING RELATIONSHIPS, GROUPING INTO LINEAGES]

AT LONG LAST—SEEDS ON LYCORIS SQUAMIGERA

Sam Caldwell
6791 Holt Road, Nashville, Tennessee 37211

In the early 1950s when I started hybridizing lycorises I tried crossing everything available, including, of course, *L. squamigera*. Over several years I spread pollen from *L. squamigera* to every other *Lycoris* that was blooming and pollen from other species onto *L. squamigera*, with very discouraging results—not a single seed. Then a botanist friend told me, "*Lycoris squamigera* is an infertile triploid," and I read in Traub and Moldenke's *Amaryllidaceae: Tribe Amarylleae* that "*Lycoris squamigera* appears to be a sterile natural hybrid, not represented in any fertile wild populations. . . ." Having little botanical knowledge myself, I was impressed by these statements and concluded that in my innocence I had been trying to do something impossible. Also at the time I was getting good results and many seedlings by using *L. sprengeri*, *L. sanguinea* and a fertile strain of *L. radiata*, so I just dropped all efforts with *L. squamigera*.

Nevertheless, over years that followed I would occasionally hear or read of someone claiming to have seeds on *L. squamigera*. I carefully investigated every report and rumor that I could and in every case found it to be in error. The reason seemed to be that to average gardeners *L. squamigera* (see Fig. 6) does *appear* to make seeds. After the flowers fade large seed capsules often develop, filled with chaff and bits of aborted seeds which are worthless but to the unintiated do look like flower seeds.

Speculating that somewhere, someone might really have a fertile strain of *L. squamigera*, I wrote a letter that was published in the September, 1975 issue of *Flower and Garden* magazine, which circulates among more than a half million gardeners. I explained the situation surrounding *L. squamigera*, the Magic Lily, and requested any reader having one making seeds to get in touch with me.

My letter drew some thirty responses—tributes to the warm-heartedness, generosity and spirit of helpfulness that prevails among garden-minded people. Unfortunately, these attributes are not always coupled with much horticultural knowledge, for it soon became clear that more than twenty of the writers didn't know what a lycoris was. The common name, Magic Lily, covered a lot of ground for them and they sent me seeds of *Hemerocallis*, *Hymenocallis*, *Amaryllis*, *Brunsvigia rosea* and even stem bulbils from stalks of *Lilium tigrinum*. Then eight correspondents sent dried seed capsules of *L. squamigera* containing the

usual worthless chaff that they thought was seed. Exactly one person—a lady in Dublin, Ohio—sent me three real lycoris seeds, which I planted.

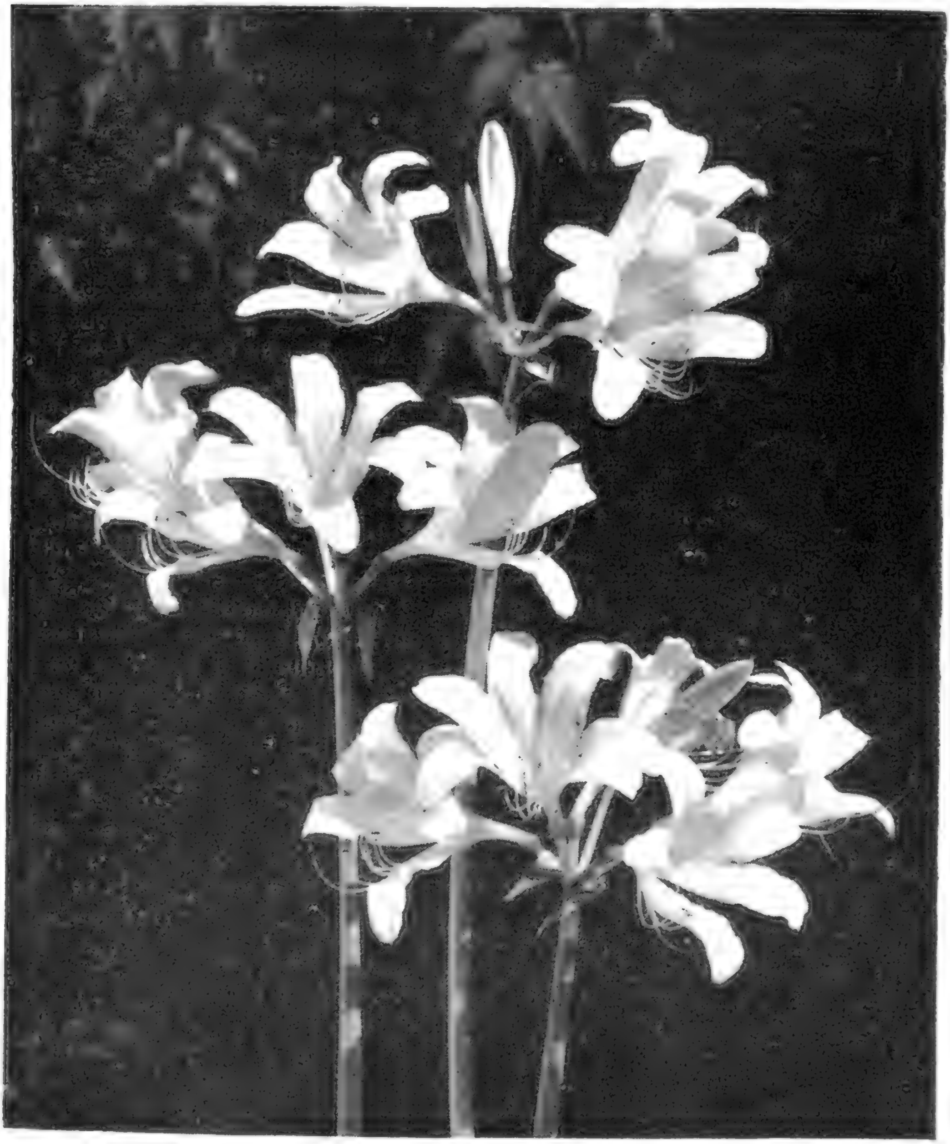

Fig. 6. It is just a matter of finding the right mate! **Lycoris squamigera** Maxim., long thought to be sterile, set seeds when crossed with **Lycoris chinensis** Traub. Photo by Sam Caldwell

However, from information supplied in her letter and from the appearance of the one seedling I now have growing, I feel sure that this is *L. sprengeri.*

By coincidence I received from Japan at about this time a letter from my good gardener friend, Dr. Shuichi Hirao, who wrote: "I want

Fig. 7. **Lycoris chinensis** Traub has a big and beautiful flower, orange-yellow in color. Photo by Sam Caldwell

this letter to report you my 'finding' on lycoris. It is to obtain seed from sterile species. The practice is very simple: just cut the bloomstalk after pollination and hang it downwards in the shade, or just lay on a shady ground. The stalk will shrivel gradually from the cut end. but the umbel will continue to live and the pod will swell gradually. If lucky you will find one or more perfect seed in the pod after four to five weeks after the pollination. I got a perfect seed out of three umbels of *Lycoris squamigera* treated above.''

So in the flowering season of 1976 I went back to work on *L. squamigera*, using pollen from *L. sanguinea*, *L. sprengeri*, *L. chinensis*, L. "Sperryi" and from a new unidentified yellow lycoris that looks much like *L. squamigera*. Reciprocal crosses were made. I cut about 40 scapes, labeled them and hung them in light shade in my greenhouse. For a time they made progress; seed capsules fattened in an encouraging way. However, in September when they were fully ripened it was a disappointing task to shell out the capsules, umbel after umbel, and find no seed. But one scape looked particularly good and, sure enough, when I peeled away the capsule covering, there they were—three large, shiny, hard black seeds, one of them fully 3/8″ in diameter. This may sound absurd but plant breeders will understand—it was like finding gold nuggets after a 20-year search!

A label showed that this was the only scape of *L. squamigera* on which I had applied pollen from *L. chinensis*. The secret was out. *Lycoris squamigera* could produce seed in cooperation with the right partner. And as one might guess, *L. chinensis* is something special. It is the big, beautiful hardy yellow "spiderlily" type lycoris received in 1948 at the U.S.D.A. Plant Introduction Garden in Glenn Dale, Maryland from the Nanking, China Botanic Garden. It came under the label. "L. aurea," but proved quite distinct from what we regard as true *L. aurea*, that grows in St. Augustine, Florida and other mild-winter areas. Dr. Traub named it *L. chinensis* in 1958. (See Fig. 7).

There are few bulbs of the species in this country. I have had it since 1958 and still have only two flowering size bulbs. Last year I dug my first acquisition, planted as a single bulb in 1958. There was still the original bulb, 1 1/2″ in diameter, one additional bulb slightly smaller, and two offsets about 3/4″ in diameter a very miserly natural increase after 19 years of growth, during which time it has borne a single good flower scape in July of nearly every year. It is very fertile and sets good crops of seed to its own and other pollens. Oddly enough, though I have raised hybrids with *L. chinensis* as the seed parent, I have never been able to bring up a mature bulb from self-pollinated seed. They germinate fairly well but under exactly the same conditions that I routinely grow other lycoris seedlings, the little *L. chinensis* bulbs just disappear after two or three years. No doubt it is possible to grow them; I just haven't found the way.

Now back to the story of my 1976 crop of the three hybrid seeds, *L. squamigera* ♀ X *L. chinensis* ♂. These were planted in a 4″ pot kept under a bench in my cool greenhouse oven winter, as I customarily

handle all lycoris seed. In March I carefully dug into the planting medium and was happy to find two small white bulblets emerged from black seed covers. It was a sad day a few weeks later when I again dug in and discovered both bulblets rotting.

Fortunately the next flowering season, 1977, was a good one. There were two scapes of *L. chinensis*, supplying plenty of pollen for use on dozens of *L. squamigera* flowers. Some of these I cut and hung in the greenhouse, others were placed in the greenhouse in a jar of water which was changed occasionally, and still others were left outside on the bulbs as an experiment. Those in water all decayed after a few weeks, but

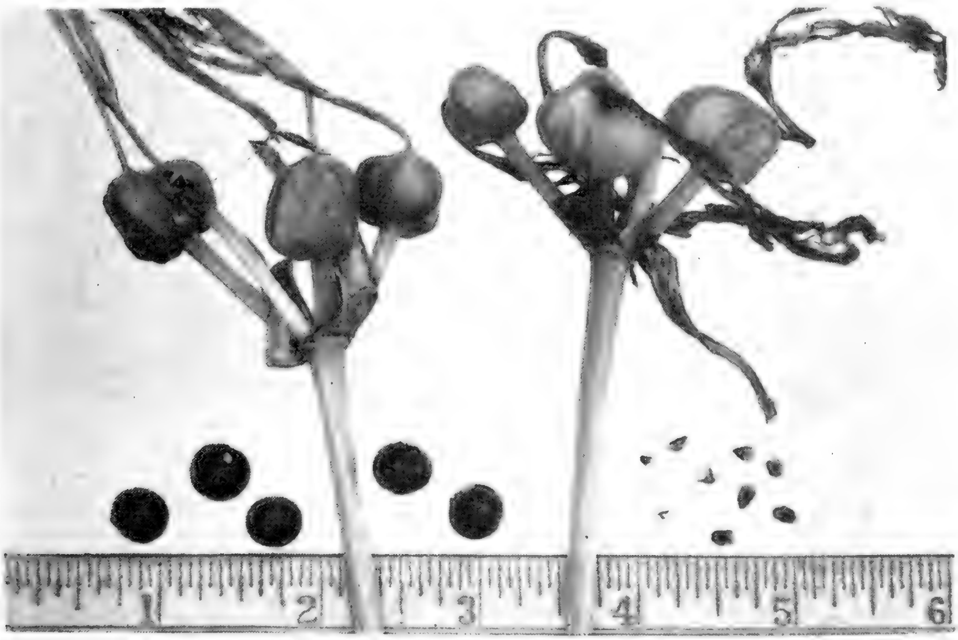

Fig. 8. Fruit (seed pods) and seeds of **Lycoris squamigera** Maxim. when crossed with **L. chinensis** Traub. Capsules contain a few large, round seeds, shown at left, but are filled mostly with worthless aborted seeds shown at right. Ruler scale in inches. Photo by Sam Caldwell

from the greenhouse hung scapes and those gathered outside in mid-September I was delighted to get 36 mature, sound seeds. (See Fig. 8). In fact, those pollinated scapes left outside on their bulbs were quite as productive as those brought into the greenhouse, so it would appear that cutting and hanging is unnecessary.

Actually, the ratio of seeds to pollinated scape was low. Many scapes produced no seeds at all. Six was the most from any one scape, while the over-all average was slightly over one seed per scape, although I had generally pollinated every flower.

This time, hoping to avoid decay of small bulblets, I planted the

seeds in a peatmoss-vermiculite mix with a fungicide added. The same medium was used for all my other lycoris seeds of the 1977 season, and these germinated and grew well. Not so the squamigera seeds. It is sad to report that about half of them apparently rotted without germinating at all. Others did germinate and develop plump little bulblets but these also decayed within a few months.

Discussing the problem with friends who are experienced plant propagators, I was told that these seeds undoubtedly can be started successfully under aseptic culture in a properly equipped laboratory. In fact, one who is connected with a government agency having adequate facilities offered to start seeds that I might supply. I hoped to take advantage of that offer this year but it turned out to be one of those years when I had no bloom on *L. chinensis*, nor were there any flowers on the species at the Plant Introduction Garden in Maryland. Thus there was no pollen for fertilizing *L. squamigera* flowers.

But there'll be another year . . . more lycoris blooms . . . more pollen spreading . . . more of the illusive seeds on *L. squamigera* . . . more years of waiting as seedlings grow to flowering bulbs. What a hybrid might result! How will the traits of orchid-tinted *L. squamigera* combine with those of the golden ruffled Chinese parent? Answering a question like that provides endless fascination for the avid plant breeder.

1978 LYCORIS REPORT

Sam Caldwell,
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Since my "1970 Lycoris Report" (*Plant Life* 1972) my interest in collecting and hybridizing this genus has continued unabated. Although their 1978 flowering season was poor—due probably to extremely severe winters of both 1976-'77 and 1977-'78—recent years have brought several developments worth recording. Most important, I believe, is the performance of three new unidentified lycorises, all of which may be named eventually as new species.

I am indebted to Dr. Shuichi Hirao, a biochemist of Kanagawa, Japan for supplying me with these and other rare bulbs. A lifetime hobby gardener, he is deeply involved with varied horticultural interests, including Japanese irises, daylilies, daffodils, nerines, lycorises and other amaryllids.

Lycoris #251 (see Fig. 9). (Since these lycorises are un-named, I shall designate them simply with my acquisition numbers.) In August, 1970 Dr. Hirao sent me two fairly large, long-necked bulbs, about 2″ in diameter near the base, with strong live roots, along with a note saying they were an unknown species with flowers "pearly pink, overlaid light blue."

Knowing nothing of their hardiness, I planted them in one of the coldframes where I grow most lycorises that need winter protection. They made no foliage in the fall but in late January leaves began pushing up. These grew on, much in the manner of *L. squamigera*

foliage except that blades were not as wide as in that species. They died down in late spring.

Newly acquired lycoris bulbs often fail to bloom the first year after planting, so I was pleased to get one sturdy scape with a nice umbel of flowers early the next August. (See Fig. 9.) Bulbs have multiplied reasonably well and have bloomed every year since then. Scapes run mostly from 21 to 24″ in height, with umbels about 8¼″ across. Flowers

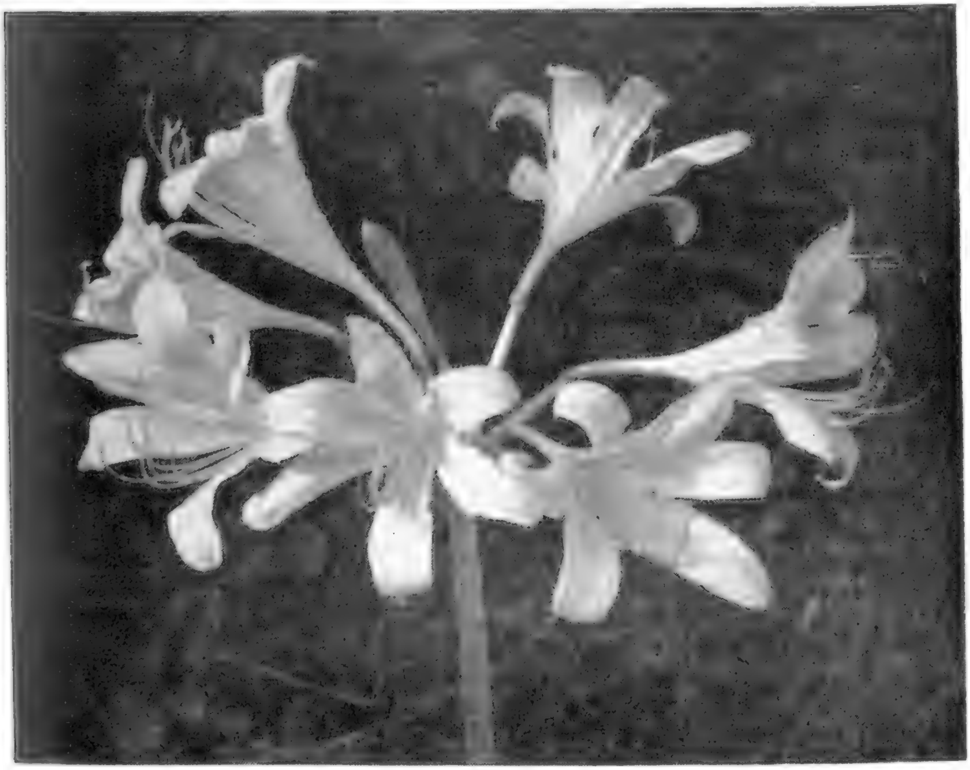

Fig. 9. **Lycoris** species (unidentified), No. 251. Un-named with lilac-colored flowers, somewhat resembling **L. sprengeri** Comes ex Baker. Scape 22″, umbel 8¼″ across, flowers 2½″ across, segs to 7/16″ wide. Photo by Sam Caldwell

are 2½″ across, segments up to 7/16″ wide. Dr. Harao's color description is quite accurate but for brevity's sake I usually just call it lilac.

This lycoris would not be confused with any other species that I know, though it is nearest in general appearance to *L. sprengeri*. Besides the color difference, it usually blooms earlier than that species and has somewhat taller and larger scapes, though they do not approach the size of *L. squamigera*.

Lycoris #251 seems to be only moderately fertile; most years some of the scapes will produce just one or two large, sound seeds from selfed or cross pollinations. These have germinated and I have a few seedlings coming along but none of blooming size yet. Also, I've used the rather scant pollen on *L. radiata* and L "sperryi" with apparent succeess and have small seedlings of these.

Because the bulbs had faliage habit similar to *L. squamigera,* I hoped that they might be equally hardy. So in November, 1973—three

Fig. 10. **Lycoris** species (unidentified) No. 252, white, faintly flushed lavender-pink. A sturdy, vigorous grower which appears to be developing seeds, which never mature. Photo by Sam Caldwell

years after the original planting—I dug one of the coldframe bulbs and found it had increased to four fairly large bulbs. Two of these were set back in the coldframe and, as a test, the other two were set outside at different locations where I have various hardy species naturalized. One of thesse bloomed just once, in 1975, but now both have disappeared. While this cannot be considered a conclusive hardiness test, I do fear that this lycoris will not thrive without coldframe protection in winter in my area. Zero temperatures are not unusual for us in early February and killing frosts occur until the end of March. Leaves on *L. squami-*

gera are able to survive without appreciable damage, but I noticed that foliage of #251 was badly hurt by cold spells when there was no snow cover.

Still this is a quite pretty and interesting lycoris, well worth space in my coldframe, and whenever bulbs become available it should prove satisfactory outdoors in slightly milder climates.

Lycoris #252 (see Fig. 10). It was also in August, 1970, that Dr. Hirao sent me two bulbs described as an unknown species bearing "off-white" flowers. They were tall and slender, about 1½" in diameter near the base, firm and sound but dry and without roots. These, too, were set in a coldframe. Performance has been about like that of the lilac-flowered #251; they grew off well, first flowered in August, 1972, and since then have multiplied satisfactorily and bloomed well. Foliage resembles that of #251 but doesn't come up until along in February, two or three weeks after #251 has started. As shown in Fig. 10, the flowers have a clean-cut style of their own. Scapes 20" or more tall are thick and sturdy. Umbels run about 8¼" across and flowers 3 to 3½" across with segments up to ⅝" wide. The over-all effect is a sparkling white, but in truth "off-white" is more accurate, since there are lavender-pink flushes, particularly on the back side of segments, and the color shows strongly in style and filaments.

After flowers fade this lycoris proceeds as though it were going to make a bumper seed crop, as capsules grow plump and shiny. But it is a promise never fulfilled, for no viable seeds develop. And the pollen, when applied to other species in my hybridizing efforts, has never produced seed. Dr. Hirao reports similar negative results.

Limited trials of #252 for winter hardiness under outdoor cultivation indicate that it may not be reliable in my area, so I keep it under coldframe culture.

Lycoris #289 (see Fig. 11). This is probably most important of the three new lycorises. My first bulb came in October, 1972 from Dr. Hirao, who wrote "This has no botanical name yet, so far as I know. It is a light yellow L. squamigera type flower. . . . I think it was found among the imported bulbs from China about 30 years ago or maybe more." Then in the fall of 1974 a letter arrived from Mr. Satoshi Komoriya, a rare bulb fancier and dealer of Chiba-shi, Japan, in which he stated, "I now have a small quantity of *L. straminea*, which is said here to have been extinct. This is very similar in the habit and shape of flowers to *L. squamigera*. Recently one of the professional journals here reported on my L. straminea."

In exchange for some of my hybrid lycorises Mr. Komoriya sent me two bulbs of "L. straminea." One of these I planted out of doors and the other in my coldframe near the unnamed bulb received two years earlier from Dr. Hirao, since I suspected from descriptions that they might be the same. This was confirmed later when they bloomed together.

As a matter of fact, for the first year or two I thought both gentlemen had sent me *L. squamigera* bulbs by mistake, the broad-bladed

Fig. 11. **Lycoris** (unidentified) No. 289, with yellow flowers (left) beside a scape of **Lycoris squamigera** Maxim. (right). Note close resemblance except for the yellow color, and the unusually longer tepaltube at the base of the tepelsegs. Photo by Sam Caldwell

foliage starting up in late January and dying down in spring was so much like that of squamigera. Dr. Hirao's bulb bloomed in late July, 1976, and dispelled my doubts; it was indeed yellow-flowered. (see Fig. 11.) Both bulbs in the coldframe bloomed together the next year and the Hirao bulb again in 1978. The one bulb planted outside has survived our winters but evidently doesn't like them as it has never flowered.

L. #289 is a big lycoris, with about the same stature as *L. squamigera* and blooming at the same time. (See Fig. 11). Some might regard it as just a color variant of that species.

One important—and fortunate—difference is that it is extremely fertile. It produces copious quantities of pollen which seems to "take" on all the other fertile species, and its own self-pollinated flowers bear full capsules of very large seeds. At this writing none of my seedlings are more than two years old, so I cannot report on ultimate results, but thus far all indications are favorable.

It is a good thing that seed propagation is feasible, because not one of my bulbs shows any sign of increase by offsets, although one has been in the ground six years and the other two, four years. And while seed propagation is slow, it does mean that this lycoris should be available eventually to many gardeners.

Still to be settled is the matter of identity of #289. Some Japanese botanists regard it as the long-sought-for *L. straminea*, but there is substantial evidence against such a conclusion. The name *L. straminea* was published in London in 1848 by Lindley for a plant sent from China to Kew Gardens by Fortune. The type material was still on file at the Cambridge University Botany School Herbarium in 1954, when Dr. Traub managed to get a photograph of it. (*Lycoris straminea* Lindl. emend. Traub, PLANT LIFE 1956, p. 42.) This shows a relatively small lycoris with long exserted stamens and style and segments reflexed and ruffled in general resemblance to the form of *L. radiata*, *L. albiflora* and *L. aurea*. Obviously this is not the plant we have now. So here is more work for taxonomists. Perhaps a newly named species will emerge.

There has been speculation that *L. squamigera* itself may have resulted from a crossing in the wild of this *L. #289* and *L. sprengeri*, both natives of China. I have made this cross, along with many others involving #289 during the past two years, and look forward eagerly to observing what the future will bring in my "lycoris nursery."

NOTES ON **CRINUM JAPONICUM** (Bak.) Hann.

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During the past year some information has come my way concerning *Crinum japonicum* (Baker) Hannibal (syn. *Crinum asiaticum* Linn. var. *japonicum* Baker) that should be of interest to amaryllid collectors. I have also acquired some plants of the varieties to be mentioned in this article. At a later date the various forms of *C. japonicum* will be de-

scribed in more depth. Photographs will be published to show the diversity of this amaryllid.

The first accession of *Crinum japonicum* I received was seeds of the typical, green leaved form. These seeds took between six and eight months to germinate, most of that time outside of the greenhouse. It is assumed that germination would have occurred sooner, had the seeds been in the greenhouse from the start. Nevertheless, Les Hannibal has stated that seeds of Crinum pedunculatum have taken two or three years to germinate. So, the six to eight month wait for the germination of *C. japonicum* was not excessive.

From a friend in the Philippines I received news about the various variegated forms of *C. japonicum* that were grown principally in Japan. These plants are naturally-occurring mutants. The three cultivars described below are all extremely rare, and are prized in Japan.

''Akebono'' has leaf tips which are flushed white. This is an extraordinary type of variegation for an amaryllid, and I have not heard of any other instance in the family of this variegation.

''Han-ire'' is the spotted form mentioned by some authors. This highly ornamental plant has light green leaves, spotted with yellow. It is the type of interplay of colors that would be expected of a dweller of the tropical forest floor, not a Japanese sand dune plant.

''Shima-ire'' is a rhizomatous, striated form of the species. The leaves of this mutant are the typical green color, frequently striated with white. The presence of the rhizomatous root system seems to distinguish it from the other forms of *C. japonicum.*

At this time, I am still trying to obtain plants of *C. japonicum* ''Akebono'', the extremely rare, white-tipped mutant. I have managed to acquire some plants of the other forms, and some plants have been distributed to a botanic garden in Hawaii.

Baker established the Japanese *Crinum* as a variety of *Crinum asiaticum,* its distinguishing features being firmer leaves, and the plant being smaller in all its parts than the typical species. Hannibal later established the Japanese variety as a separate species.

Crinum japonicum occurs in southern Japan, as well as islands off the southern coast of Japan. As mentioned earlier, it is a dune-dweller. apparently living in beach sands, and extending almost to Tokyo in the north.

The plants of *Crinum japonicum,* including the mutants, have been grown in a mix consisting of two parts good quality loam, one part fine sand, and one part redwood shavings. Lime and Superphosphate are added to this mix. Benomyl is applied periodically to combat fungi. and fertilizer is supplied in the form of a water-soluble 15-30-15, every four weeks. *Crinum japonicum* has grown well in part, or full sun. Full sun would be preferred for flowering purposes. It does not seem to require a mix restricted to beach sand, although it will grow in that type of mix. The use of peat, or other organic material that breaks

down quickly in the soil should be avoided. Beach-dwelling Crinums received from the Marshall Islands have also done very well with the culture described above.

The various forms of *Crinum japonicum*, especially the variegated mutants just described should be made more widely available. For amaryllids, their foliage is unsurpassed, and they possess the typical white flowers of asiatic Crinums.

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Hannibal, L. S., 1972, **Garden Crinums,** Bulletin of the Louisiana Society For Horticultural Research, Volume III, No. 5, 1970-1971.

THE MORPHOLOGY (GROUND-PLAN) OF **UNGERNIA**, THE ONLY ENDEMIC AMARYLLID GENUS OF CENTRAL ASIA

DIETRICH AND UTE MUELLER-DOBLIES, *Free University of Berlin*

SUMMARY

(Editorial note.—The following summary is taken verbatim as appended to the original German article appearing in Bot. Jahrb. Syst. 99 (2/3): 249-263. Stuttgart, May 16, 1978.)

Ungernia tadschicorum and *U. trisphera* show a characteristic sequence of leaves which is unique among the 32 hitherto studied genera of Amaryllidaceae: the first leaf of the main innovation bud is reduced to two minute adaxial scales, the second one is a half sheathing foliage leaf, and the following ones may be wholly amplexicaul, but the 3rd and 5th may also have an open base, the last but one is an open foliage leaf and the uppermost is a half-embracing scale leaf. When the uppermost leaves of the blooming generation and the lower ones of the following shoot generation are waiting for development in next spring. The flowering scape is thus preceding its own foliage leaves (precursive= praecurrent) and that for one vegetation period, which means proleptic behavior. Among Amaryllids this type of periodicity is only known to us from *Sternbergia macrantha.*

There is only one scape flowering per year (annual innovation) and the induction probably takes place in late summer.

The morphologic results support the recent separation of the tribe *Lycoridae* Traub from the Amarylleae, as these differ in three of the four main characters of bulb morphology.

Address of the authors: Prof. Dr. D. Mueller-Doblies and Dr. Ute Mueller-Doblies, Paulsenstr. 47a, 1000 Berlin 41.

HYMENOCALLIS CHIAPASIANA SP. NOV.*

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I was accompanied by Stephen C. Lowe, of San Antonio, on my 1970 annual plant collecting trip into Mexico. At the end of our search in mid-July, in the State of Chiapas, we located a *Hymenocallis* species in leaf, *Howard No. 70-59*, associated with *Calochortus* sp., light yellow flowers with wine throat.

This species apparently flowers a month earlier in its native habitat, due to the 6000 ft. elevation, and high rainfall. The climate is very mild and spring-like. The City of San Cristobal de las Casas lies in an alpine valley surrounded by pine forests and meadows.

The bulbs of *No. 70-59*, have been flowered at my home in San Antonio annually since 1971, and proved to be a new species which I am naming in honor of the State of Chiapas.

HYMENOCALLIS CHIAPASIANA SP. NOV. T. M. HOWARD

Hymenocallis chiapasiana a H. choreti differt tubo tepalorum curvato, scapo bimarginato, valvis spathae majoribus, cupola staminінum marginibus plus erectis, floribus multo magis suaveolentibus, et fructus striata.

Specimens grown at Santonio, Texas, from bulbs collected ca. one mile S.E. of San Cristobal de las Casas, State of Chiapas, Mexico, July 12, 1970. TRA No. 1185 (Holonomenifer), May 24, 1978; TRA No. 1186 (Paranomenifer), May 20, 1971.

Description.—*Habitat:* Chiapas, vicinity of San Cristobal de las Casas in rocky outcropping surrounding a valley, flowering with earliest summer rains in May or June and becoming dormant in July. Elevation ca 6000 ft.

Description.—*Bulb:* ovoid, 5 cm wide and 6 cm long, with brown tunics. *Leaves:* 3 to 5 in number, glaucous, oblanceolate to obovate, acute, petiolate to sub petiolate, 20 to 30 cm long and 2.5 to 4.5 cm wide in the middle, tapering to .5 cm wide at the base. *Scape:* 13 to 38 cm tall, compressed with two distinct edges, umbel 2- to 6-flowered. Flowers white, sweetly scented, one or two scapes per largest bulb. *Spathe valves:* 4 or 5, 4 to 6 cm long, lanceolate, .8 to 1 cm wide at the base. *Tepaltube:* slightly curved, (living material), 5.5 to 7.5 cm long, green in lower 2/3rds, white in upper ⅓. *Tepalsegs:* 5.5 to 6.5 cm long, spreading, slightly recurved to strongly recurved in living specimens, .4 mm wide. *Staminal cup:* funnel form to nearly rotate with margins nearly erect or slightly spreading, from short tubulose base, 1.5 cm long and 1.5 cm wide. *Filaments:* 3 cm long, green; anthers versatile, with orange pollen. *Pistil:* 5-8 cm long, longer than fils. *Ovary:* ses-

* **Editorial Note.—Received on October 15, 1977 for the 1978 PLANT LIFE, but was held over for the 1979 issue.**

sile, *one to 2 ovules* per cell; *Fruit:* oval, 1.6 to 1.8 cm long, and 1.3 cm wide, striated, pale green with semi-gloss, smooth, rounded surface.

Notes: One of the earliest Mexican species to flower, flowering in May or early June with the first rains of summer. Distinguished from *H. choretis* (the only species it is apt to be confused with) by its curved tepaltube, compressed two edged scape, larger, better developed spathe valves, smaller staminal cup having more erect margins, much more pleasantly scented flowers, and striated fruits. *H. chiapasiana* grows at higher elevations than *H. choretis*, and flower a full month or more earlier in the season.

CORRIGENDA - PLANT LIFE vol. 34, page 64. 1978

Page 64, first line for **HYMENOCALLIS QUERREROENSIS** read **HYMENOCALLIS GUERREROENSIS.**

HYMENOCALLIS SPECIES FROM SOUTHERN MEXICO *

PIERFELICE RAVENNA,
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HYMENOCALLIS BAUMLII Rav., sp. nov. (Fig. 13)

Species a *H. tenuiflora H. litoralis* et *H. acutifolia* similis necnon a prima faliis crassioribus angustioribus erectis vel suberectis, ab alteribus tepalis e base poculae staminiferae liberis recedit.

Flores sessiles. Perigonii tubus pallide viridis ad 10-13 cm longus circ. 3.4 mm latus. Perigonium album 12-15 cm latus. Tepala usque 9 cm longa 3.7 mm lata. Corona infundibulata ad 18 mm longa circ. 18 mm lata basin versus angustiora. Filamenta et stylus sordide virides.

Plant up to 54-66 cm high. *Bulb* widely oviod, to 47-60 mm long, 40-50 mm wide, prolonged into a pseudoneck. *Leaves* often 7, ensiform, arising simultaneously as the flower-scape, erect, distic, subcarinate, moderately channelled, subacute, to 20-33 cm long, 19-25 mm broad. *Scape* almost cylindrical, not at all edged, to 36-46 cm long, 7-12 mm in cross section. *Spathe* marcescent; *valves* lanceolate, free to the base, to 30-33 mm long. Inflorescence 4-8-flowered. *Ovary* ellypsoid, sessile, to 10-12 mm long, 6-8 mm wide, green. *Flowers* spreading unright or erect, very delicate. *Perigone tube* 10-13 cm long, 3.4 mm across. *Perigone* 12-15 cm in diameter. *Tepals* linear subequal, white, lax, moderately recurved, to 9 cm long, 3.7 mm broad. *Staminal cup* very thin, to 18 mm long, 18 mm wide, much narrower below. *Filaments* dull green, 4-5 cm long. *Anthers* linear-versatile, thin, to 11-13 mm long, scarcely 1 mm broad. *Style* very narrowly filiform, dull green, to 16-20 cm long. *Stigma* capitate, small, viscose.

Habitat.—Low, open places between Cintalapa and Tuxtla-Gutiérrez, in the State of Chiapas, Mexico.

* Received for publication in Plant Life October 19, 1978.

Specimens: In graminosis humidis inter Cintalapa et Tuxtla-Gutiérrez civit. Chiapas Mexici; leg. Ravenna 2173, VI-1976 (typus in Herb. Ravennae, isotypus BH).

Hymenocallis baumlii belongs in the Series *Litorales*, its closest allies being, *H. tenuiflora* Herb., *H. litoralis* (Jacq.) Herb., and *H. acuti-*

Fig. 13. **Hymenocallis baumlii** Rav., as photographed in its natural location. Photo by P. Ravenna

folia (Ker-Gawl.) Sw. From the former, it is distinguished by the thicker, erect or suberect leaves; from the other two, by the smaller size, not edged scape, and tepals free from the lower part of the staminal-cup.

The species is properly dedicated to Mr. James Bauml of Brownsville, Texas, who is preparing his Thesis on the Mexican representatives of the genus.

LITERATURE CITED

Flory, W.S., 1978. Known distribution of *Hymenocallis* Salisbury in North and Middle America and the West Indies; Pl. Life 34: 47-59.

HYMENOCALLIS NOTES

JAMES E. SHIELDS,

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It was called to my attention by Mr. James A. Bauml that his plant of *Hymenocallis* "Icon" had abnormal blooms: only 5 stamens and 5 tepals. This prompted me to examine all my yellow-flowered types of *Hymenocallis* carefully, too: only my accession JES#154, purchased in 1974 from a commercial source as *H. amancaes*, showed this trait consistently. Moreover, the staminal cup of this variety is at least 50% larger than that of any other yellow *Hymenocallis* type that I grow. An attempt at propagation of #154 by cuttage has yielded a profusion of bulblets. All this leads me to reaffirm my previous suspicion (Shields, 1977) that this plant is not simply wild-type species *H. amancaes*. Moreover, a blooming-size bulb of *H. amancaes* was supplied by the U.S.D.A., Glenn Dale, Maryland, for comparison with my #154. The U.S.D.A. bulb carried the identification number P.I.390844. This and JES#154 were planted near one another on 22 May 1978 in a freshly-prepared outdoor bed in full sun. The plants of JES#154 grew and flowered as usual, and as vigorously as "Helios", "Pax", and "Icon". In striking contrast, P.I.390844 failed to grow at all until one tiny, weak shoot appeared in late July. Thus, P.I.390844 lived up to the reputation of *amancaes* of being very sensitive to hot weather, while JES#154 behaved as do the other hybrids. I am forced to conclude that the plant referred to as *H. amancaes* in previous articles and private correspondence is not, in fact, the species.

There are also at least two distinct clones in circulation under the name *H.* "Helios". These are accessions #124 and 168. Clone #124 has a markedly taller scape, deeper yellow color, and slightly smaller florets than does #168. A clone received as "Pax" (JES#103) and a clone received as "Icon" (JES#178) correspond approximately to #168 in scape height, floret size, and color, although there appear to my eyes to be subtle differences separating the three. Bulbs of each of my yellow-flowered *Hymenocallis* varieties are being sent to Mr James A. Bauml

for his evaluation. Well-documented representative bulbs of Woelf yellow hybrids would be invaluable in assisting in the clarification this nomenclatorial mess.

In any case, any commercially-obtained bulbs of so-called *Hymenocallis amancaes* must be considered suspect. Only plants collected the wild by reputable individualss can be called *H. amancaes* with a degree of confidence. My plants of #154 appear to be a selected form hybrid of *amancaes* which was chosen for (1) flower size, (2) ease propagation by cuttage, and (3) ability to survive hot weather. It is fine horticultural variety, but surely not the botantical wild-type *H. amancaes.*

REFERENCE

Shields, J. E. 1977. Hymenocallis Culture in Indiana. PLANT LIFE 33:79.

REGISTRATION OF NEW AMARYLLID CLONES

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This department has been included since 1934 to provide a place for the registration of names of cultivated **Amaryllis** and other amaryllids on an international basis. The procedure is in harmony with the International Code of Botanical Nomenclature (edition publ. 1961) and the International Code of Nomenclature for Cultivated Plants (edition publ. 1958). Catalogs of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, **"Descriptive Catalog of Hemerocallis Clones, 1893-1948"** by Norton, Stuntz and Ballard was published in 1949. Additional catalogs of cultivars have been published since 1949: **Catalog of Brunsvigia Cultivars, 1837-1959,** by Hamilton P. Traub and L. S. Hannibal, PLANT LIFE 16: 36-62. 1960; Addendum, PLANT LIFE 17: 63-64. 1961; **Catalog of Hybrid Nerine Clones, 1882-1958,** by Emma D. Menninger, PLANT LIFE 16: 63-74. 1960; Addendum, PLANT LIFE 17: 61-62. 1961; **The Genus X Crinodonna,** by Hamilton P. Traub, PLANT LIFE 17: 65-74. 1961; **Catalog of Hybrid Amaryllis Cultivars, 1799-1963,** by Hamilton P. Traub, W. R. Ballard, La Forest Morton and E. Authement, PLANT LIFE. **Appendix** i-ii + 1-42. 1964. Other catalogs of cultivated amaryllids are scheduled for publication in future issues. These may be obtained at $8.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Jolla, Calif. 92038.

The registration actvity of the American Plant Life Society was recognized when at the XVIth International Horticultural Congress, Brussels, 1962, the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for the cultivars of **Nerine;** and this was extended to include all the **Amaryllidaceae** cultivars, excepting **Narcissus** and **Hemerocallis,** at the XVIIth International Horticultural Congress, 1966.

Only registered named clones of **Amaryllis** and other amaryllids are eligible for awards and honors of the American Amaryllis Society at Official Amaryllis Shows.

Correspondence regarding registration of all amaryllids such as **Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis**, and so on, should be sent to Mr. Weinstock at the above address. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

3. GENETICS AND BREEDING

YELLOW-FLOWERED AND OTHER AMARYLLIS HYBRIDS

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Some twenty five years ago Cecil Houdyshell forced about fifty *Amaryllis* seeds upon me in exchange for some Camellias I had given him. At that time I was very busy with Camellias and did not really want to start a new line, but since I cannot resist seeds, these were planted and flowered in due time. These flowers really jolted me, from dark red to almost pure white, and much larger than any *Amaryllis* I had seen before. They set seeds and I planted some of them, getting several distinct variations from the originals when they bloomed. The next year I hand pollinated some of the better ones, and from these got some good solid colors, and better form, and I was hooked.

My wife and I saw in the newspaper that an *Amaryllis* show was to be held at the Los Angeles State and County Arboretum, and that it was sponsored by the Southern California Hemerocallis and Amaryllis Society. We attended the Show and were much impressed by the size and colors of the blooms, especially the Dutch. As a result of the Show we joined the Society, and it has been a very pleasant association.

From the plant table at an Amaryllis Society meeting I selected a small plastic bag which had the contents of a potted plant emptied into it, and thoroughly mixed. At home I found a tag had been included which said "Senorita", a cross of *A. evansiae* by *A. striata*. I carefully potted up the half dozen small bulbs, and about a year later two of the bulbs bloomed. I was quite entranced with the bloom, first rather yellow and turning an apricot pink as the flower passed through its cycle. The idea occured to me, why not get an all yellow flower?

Pollen was taken from the "Senorita" blooms and stored, and the blooms themselves were pollinated with one of the Houdyshell hybrids, and from a Dutch hybrid. None of them set seed. However the reverse crosses did set seed, and the seed from the White Dutch (mistakenly sent to me as 'Maria Goretti') was given the number 225. These pollinations were made in the late Spring of 1970.

Starting in February 1972 the first of these 225 seedlings started blooming. No yellows, but some lovely pastel colored blooms six inches in diameter, often four blooms to a scape, and fairly wide segs and a flat flower. Very charming; very worthwhile as a pot plant. It was found that they produced offsets in great numbers, and some of these grew large enough to bloom the next year, producing 8-10 scapes per pot. Many of the blooms were open at the same time.

Number 225-C did not have much yellow, but it did have four-flowered scapes of nice size and form. This was pollinated with a cross which was blooming for me for the first time, (EA x E) *which was quite*

yellow. The first scape of 225-C pollinated was numbered 339 and the second scape 340. Seed was produced from both of them and planted in March 1972, resulting in about 20 plants of each to work with.

The first of these bloomed in February 1974 and was *quite yellow* as the flower opened, but the *yellow faded to a cream,* and red veining developed with a few red flushes along the edges of the segs. The flowers were about 5 inches in size. As other 339 plants (Fig. 14) bloomed it became apparent that there was *quite a bit of yellow in these plants,* and size was up to six and one half inches. The 340 group started to bloom also, but it was not until the Spring of 1975 that *the yellowest of the flowers appeared.* Number 340-8 and 339-16 and 17 were quite yellow with yellow veinings. They were 6½ to 7 inches in diameter with an acceptable flower form.

Attempts were made in 1974 to both self and cross pollinate from the best that had bloomed up to then, but no success was had. In 1975 a number of crosses within the group were tried, but only one cross produced a few wrinkled, twisted seed of very doubtfull viability. This cross was 339-4 x 340-6, and the seed from it were given the number 591 (Fig. 14). Several of these seed did germinate, and one grew much faster than the others. It was put in a separate pot, and in 20 months from pollination it bloomed from a little bulb about one inch in diameter. There were two flowers about 6 inches in diameter, good yellow (about the same as (EA x E), with a slight veining in deeper yellow than the ground. The flower had a flat face with segs about 2¼ inches wide, and a greenish yellow throat. In 1978 the flower was 7 inches in diameter, and 3 flowers in the scape. A trace of red veining was apparent after several days.

When 591-1 (Fig. 14) first bloomed I had the feeling that it would probably prove difficult to get it to set seed. The contrary was the case; the flower set seed from its own pollen, and that from a good yellow cross (EAE x E), and the seed germinated well in both cases. Several other crosses were made with the 591-1 pollen. At the present time the plants from these crosses are all very small, and we will have to wait more than another year to see what happens.

Number 591-2 bloomed in April of this year (1978) with four flowers, about 7 inches in diameter, Dutch type. The flowers opened quite yellow, but in a days time acquired a pink flush which was quite attractive for beauty, but detracted from the objective of a yellow flower. No crosses were made from it.

To further increase the bank of yellow material available for future work, 339 was crossed with *A. parodii,* a long tubed very yellow flower. The seedlings show *parodii* parentage strongly, however it will be two or three years before any of these bloom. In 1973 Kelly Spearman gave me some pollen from *A. papilio,* and I put it on *A. evansiae* among others, but it was the only one that took. I got three plants from the few seed, and the first bloomed in January of 1977 with two flowers about 5 inches in diameter, strong yellow with a trace of green, and bold red veining curving in the segs as in *A. papilio.* Segs were broad at the

base, narrow at the tip, twisted, and a strong yellow band the last inch of the rib. A narrow red picotee ran around each seg. This flower is interesting because the yellow color is such a deep yellow. Because of this, two flowers were pollinated with 591-1. (Fig. 14) This was not

Fig. 14. **Amaryllis** hybrids produced by C. D. Cochran. **#591-1,** (#339-4 x 340-6), flower 7″ diam., good yellow ground color, as strong as in EAX E; slight veining in deeper yellow.

#339-15: (White Dutch x 'Senorita') x (EA x E), 7″ diam. flower, ground color creamy yellow with strong yellow ribs to tip of flower.

#281-10. 'Golden Trimphator' x 'White Giant' pastel colored flowers, (8″); picotee edges, soft red frosting on segs; opens flat, lasts long.

#339-17, (White Dutch x 'Senorita') x (EA x E), 7″ diam. flower, ground color light yellow with deeper yellow along ribs, very pale orange veining after 1-2 days.

Photos by C. D. Cothran

successful, so the reverse pollination was made, seeds were set, and the plants are growing.

To me it is interesting to note that each step has produced very pretty and interesting flowers. Flowers from each step have won ribbons

at the shows. I say this to prove that it is not all work; that there is a lot of pleasure in it also. Number 339-4, -16, and 340-8 and -17 are worth keeping, for while they are not as yellow as desired, they are a big step in that direction. The *evansiae-papilio* cross is very vigorous and blooms well. One of them had four scapes this year, with three to four flowers on each scape. After one gets used to the yellow and red combination, the flowers become quite attractive.

Fragrance is slight or entirely lacking in most *Amaryllis*. It is really unfortunate that such beautiful flowers do not have a pleasant fragrance to go with their beauty. This is particularly true of the Dutch hybrids. Several species do have a fragrance, among them *A. brasiliana* and *A. fragrantissima*. Leonard Doran gave me some seed of a cross of *A. evansiae* and *A. brasiliana*. The flowers of this cross are very pretty, somewhat tubular, and for a few days have a very pleasant fragrance.

I was given some *A. fragrantissima* pollen, and by being very stingy with it I was able to pollinate several flowers. Seed were obtained, and one of the seedlings bloomed this Spring with long tubular flowers, and a very pleasant fragrance. I will be anxiously awaiting the blooming of some of the other seedlings to see if the fragrance of *A. fragrantissima* is a dominant characteristic.

Doubleness occurs very seldom in *Amaryllis*, but one of the *A. belladonna* variations became completely double, *A. belladonna flore-plena*, or *A. belladonna* forma *albertii*. McCann of Punta Gorda, Florida, a number of years ago, as described in PLANT LIFE, developed double hybrids from this little belladonna double and the ordinary large forms of hybrid *Amaryllis*. His 'Helen Hull' and 'Margaret McCann' are still in the trade. They are frequently quite double but not very large. I obtained 'Helen Hull' and flowered it. It was too double to have a pistil or stigma, but did have some rudimentary stamens and pollen. Crosses on 'Maria Goretti' produced no doubles, only medium size white picotees. Other crosses with 'Helen Hull' on Dutch hybrids have not produced doubles.

I grew 'Double Beauty' from seed given to me by Leonard Doran. I have not seen anything to equal it in size, doubleness, and beauty. However, doubleness has its disadvantages because it seldom sets any pollen. I very much wanted some more doubles, so I started working with the little *belladonna* double. It does not have much pollen, either, it blooms irregularly, and the pollen seldom caused a seed set.

A Doran 2R5 double was obtained, and since it frequently has good quantities of pollen, seedling crosses were soon obtained. Some of these have now bloomed, and three of the plants have come double. One of these doubles is an *A. yungacensis* cross which has the almost maroon coloring of *A. yungacensis*. A cross of 'Double Beauty' pollen on Dutch bloomed this year, and is quite double, and lends encouragement for some 15-20 more plants of the same cross.

This year all of the doubles have had some pollen, so many attempts were made to get seed sets on large red hybrids, such as 'Violetta',

'Nostalgia', 'Beautiful Lady', 'Queen of Night', and some of my own deep red hybrids. Seed yields were good and germination exellent. A lot of little plants are looking forward to the next two years. Some of them by the laws of chance should be double, but those not double, and having good form and color, will be excellent subjects for recrossing with doubles.

Not all of my time has been spent developing a yellow, fragrant, or double amaryllis. It seemed to me we had a great need for pastel colors. Big reds, stripes, and whites are beautiful, but not as attractive to me as the pastel colors. Goedart in Florida suggested that I use 'Golden Triumphator', and 'Glorious Victory' as my starting point. This I did, and I have obtained some excellent progeny from them. (Fig. 14) 'Glorious Victory' is very vigorous, and seems to thrive in producing seed; very large good seed. 'Maria Goretti' works well with both of the above.

Senorita was finally coaxed into setting seed. With pollen from white Dutch hybrids, Senorita yielded some very fine, large pastels with a certain cockyness that makes them very attractive. Most of the Senorita crosses produce offsets freely, and bloom precociously.

The picotees 'Dutch Doll', 'Red Lining', and 'Picotee Petticoat' were obtained and have been a joy to work with. Besides their own beautiful blooms, crosses with them have produced pure whites, picotees, picotees with red flushes in varying amounts, and small flowers with all of these characteristics. Working with them is a constant pleasure. Not any are bad, few are of show quality, but all are charming, and work with them can be highly recommended.

AMARYLLIS FOR BREEDERS

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Amaryllis are among the easiest of plants to breed for new varieties. And those who have flowered just one seedling have been unanimous in describing the experience as being far more rewarding than growing only commercial bulbs.

Inquiries that I have received indicate that there has been a shortage of material to use for breeding new forms other than standard commercial varieties and a few species. The latter are usually rather high priced and are often the diploid species which do not combine well with the more available tetraploids. However, the diploids bred as a group lead to very interesting new combinations not found in the larger types. The miniature belles suitable for windowsill culture in the north come from the diploids.

Because I have a large germ plasm reservoir of *Amaryllis* for breeding, I have been prompted to increase these plants to make this material available to the growing number of *Amaryllis* breeders. The need that I see is for plants of known genetic composition and for certain types with particular attributes such as disease resistance or cold

hardiness. As stocks of such plants become available, they will be offered on a wholesale basis.

Of particular note at this time are seedlings from crosses of white Dutch pollinated with an induced tetraploid hybrid of *Amaryllis evansiae, A. aglaiae* and *A. parodii.* The primary hybrids of this cross all have pigments other than the desired yellow. But in contrast to the earlier hybrids of *A. evansiae* x white Dutch, these have high fertility—allowing self or sub pollinations. The earlier hybrids were triploids which set very few seeds and it is all but impossible to obtain seed set among triploids alone.

All other classes of *Amarylils* hybrids described in the Amaryllis Manual will be represented. But it may be several years before most are available in any quantity.

DOUBLE AMARYLLIS UPDATE

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In the months following the article on my double amaryllis in the 1978 issue of PLANT LIFE, I have received many inquiries about my doubles and some excellent breeding advice from Dr. William D. Bell of Gainesville, Florida. I am currently waiting for 350 seedlings to bloom, so I can put some of Dr. Bell's advice to use.

The seedlings are offspring of all the doubles registered in the last PLANT LIFE issue. Dr. Bell's advice was to use semi-double plants as the female parents, after first making sure that the plants have a viable stigma. If a semi-double will make seed, chances are greater to get better doubles. I am really looking forward to this batch of seedlings blooming this fall or winter.

ROLE OF MUTATION BREEDING IN **AMARYLLIS**

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In *Amaryllis* breeding the most prevailing method of inducing variability is by means of conventional breeding at the varietal level. However, limited success has also been achieved by raising interspecific hybrids (Parkash Narain 1974), since sterility of the F_1 hybrids thus raised poses a problem of raising a second generation wherein the segregants are expected to provide new and novel garden cultivars. Polyploidy has also produced flowers of larger size in *Amaryllis* cultivars.

The present study on mutation breeding in this ornamental plant was taken up at the division of Vegetable Crops and Floriculture, I.A.R.I., with a view to determine the efficacy of different doses of irradiation from the stantpoint of producing new and better forms for flower size, flower shape, number of florets per spathe and colour of the flowers. The results of this experiment obtained are briefly summarised

here.

MATERIAL AND METHOD

Five bulbs of *Amaryllis gracilis* cv. 'Dutch Red' were irradiated with 0.5 and 1 KR dosage of gamma-irradiation at the J. N. University, New Delhi, during Jan. 1977. Prior to that still higher doses had been tried which were lethal. The bulbs were immediately planted after treatment along with their respective controls. Before irradiation, the

Fig. 15. **Amaryllis gracilis** cv. 'Dutch Red'. **Top** flowers, control; and **bottom** flowers, mutant.

roots and leaves were cut so that the bulbs had a smooth entry into the gamma cell. The dose rate was 3.5 KR of gamma rays per minute.

Portions of 0.5 gm fresh petals of cv. 'Dutch Red' of *Amaryllis gracilis* and its induced mutants were taken for estimation of Flora-chrome-B pigments according to the technique of Kaicker & Pandey, 1973. The fresh petals were then crushed in agate morter and by adding 15 ml of acetone the pigments were extracted. In order to make the

extract free from colloidal particles it was centrefuged, using the Jantzki K70 centrifuge, for 15 min. at 2000 R.P.M. and the percentage of absorption was observed with Sepectronic-20 (B&L) at 570 mu-wavelength. The differences between the relative amounts of Florachrome-B in control and mutant plant were observed.

RESULTS

Growth data and development of the bulbs under different treatments showed that growth was diminished with increase in the dose rate. In the first year all the treated bulbs were very slow in growth in comparison with the control. All these treated bulbs flowered in the same season but without any change in flower characteristics except that *they were late* in flowering by about one month over its respective control.

In the second year the growth was still much retarded in the 1 KR treatment and sprouting was late by 15 to 30 days. In this treatment bulbs produced hardly one or two leaves which were smaller in size, almost half normal size, thick narrow and twisted. All the bulbs in this higher dose did not flower through out the season. In case of the 0.5 KR treatment, growth of the bulbs was also slow and retarded in comparison to the control. The sprouting of bulbs was about 15 days later than the control. This treatment has given several flower mutants which are described as follows:—

MUTANT NO. 1

In this case plant growth was normal except some changes in leaf size. The leaves were about 20 cm long and 3.5 cm broad while in control it was 30 to 36 cm long and 4 to 4.3 cm broad.

This mutant was 14 days later in flowering than its control. The flower stalk was smaller in size (24 cm long; in the control it was 40 to 45 cm long). The flower stalks were variable. All flowers were bicolour i.e., red and redish white striped throughout the perianth as compared to the control which was pure red in colour (See Fig. 15). The other variation was in the number of tepals, stamens and stigma. In four flowers there were 10 tepals, 10 stamens, (eight long, two were very small) with smaller anther lobes; the stigma became broader and flatter. The respective control had six tepals, six long stamens with larger anther lobes and long trilobed stigmas (see Fig. 16).

Second flower had 6 bicolour tepals, 4 were bilobed, giving it a double appearance as found in the natural mutant. It had 7 stamens with small anther lobes; one stamen was very small, petaloid and twisted, the stigma rudimentary, and completely hidden near the base of stamens suggesting there by that the ovary was infertile which was also expressed by no seed set at a later date.

The third and fourth flowers were also different in colour. 6 red tepals with redish-white stripes. The petals were lenceolate, with bifurcated apex, similar to the natural double mutant. Of the 6 petals, two were pointed, petaloid, with growth at the center. It had 6, long stamens with long anther lobes as in the control. The stigma was also long

Fig. 16. **Amaryllis gracilis** cv. 'Dutch Red'. **Left**, control, **top** two rows; mutant, **bottom** two rows. **Right**, control, **top** two rows; mutant, **bottom** two rows.

(5.5 cm in length) and flat instead of trilobed as in the control. All flowers were mosaic for colour and shape.

MUTANT NO. 2

In this mutant, vegetative characters were the same as in above mutant No. 1. The only difference in flower was that it was borne on a small stalk (size 16 cm long). It had 3-bicolour flower. The flower color was red with reddish white stripes. Each flower had 6 notched tepals, 6 stamens with small anther lobes, stigma long and flat, while in another flower it became rudimentary and was hidden at the base of flower. All flowers were mosaic in its colour.

MUTANT NO. 3

Vegetative growth of this was slightly vigorous in comparison to the other two above mutants. It was 10 days later in flowering than the control. The change brought about was in flower colour and shape. The flowerstalk was 36 cm long, bearing 6 flowers per scape. All flowers changed in colour and they were different in number of tepals, and stamens.

One flower had 8 bicolour tepals with red and reddish-white stripes; two tepals were fused making the total number of petals 10 (Fig. 16). It had 9 stamens, 3 were very small, having filaments only 1.5 cm long. All these three stamens were twisted, bearing small anther lobes. In this case stigma was also very small and twisted and hidden near the base of stamens suggesting thereby that it was female sterile which became evident when later no seed was set.

Another flower had 6 bicolour petals, 6 stamens, (5 with long filaments and large anther lobes as in control) while one stamen was small with a small anther lobe and twisted filament. The stigma was long and flat.

Still another flower had 6 bifurcated, bicolour petals showing a tendency toward doubleness. It had 10 stamens, 3 were small and twisted; stigmas were rudimentary.

Fourth to sixth florets had only 3 bicolour tepals which were formed by fusion of two tepals, as shown by the bifurcated apex of the tepals. Flowers had 4 stamens with small anther lobes. One stamen in each flower was twisted at the base. In all cases the stigma was long and flat.

Florachrome studies. The acetone extraction of tepals by the methods described earlier gave suitable florachrome extracts which showed absorptions bands in satisfactory strengths in control and mutants. The results are presented in Fig. 17, which indicates that the method employed gave differences by spectrophotometry in the mutants of 73% optical density at 570 mu wave length in comparison to the respective control which was 80%. Both visual, and spectrophotometric optical density results suggest that the light colour of the mutants, was due to the *gamma ray* treatments.

CYTOLOGICAL ANALYSIS

That irradiation also effects the fertility of the flower is well known. In all the mutants obtained, pollen fertility was reduced from 40 to 45% as against the control with 84% fertility.

DISCUSSION

It is evident from the results that mutation breeding of *Amaryllis* can give rise to similar flower mutant to those obtained in other ornamental plants heretofore. Stunted growth, leaf curling, flower colour, (red to reddish-white stripped), different flower forms, increasing number of tepals giving rise to doubleness, induction of female sterility, stamen number, and possible increased number of florets per stalk, can be induced as genetic changes by gamma-irradiation.

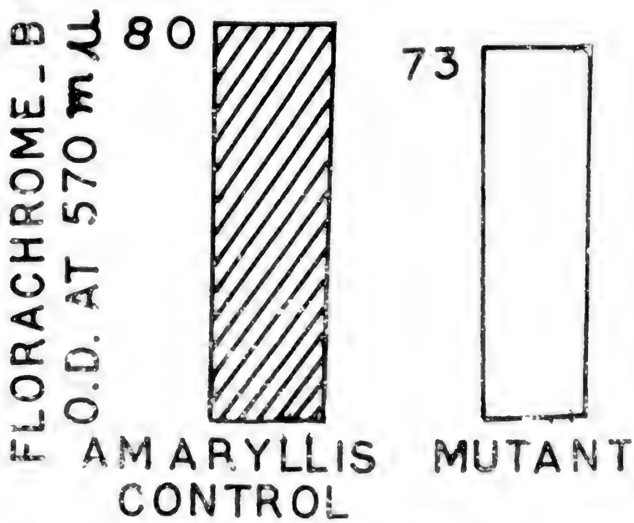

Fig. 17. **Amaryllis gracilis** cv. 'Dutch Red'. Relative amount of florachrome-B in controls and mutants (expressed as percentage O. D. of fresh weight basis.)

With mutants it is necessary to practice selection for several generations to develop a satisfactory mutant line which will be an improvement over the parental types. The qualitative variations in colour, is governed by the genetic mechanism. Pure clonal selections of these mutant would provide new cultivars hitherto unknown in *Amaryllis*, as shown by results obtained in different crops. Flower mutants for doubleness and color etc. have been reported in *Tithonia* by Kaicker, Swarup & Singh (1971). Similar doubleness was induced in Sweet Pea by Kaicker & Swarup (1971). In roses bicolour mutants were obtained by gamma-irradiation and chemical treatments by Kaicker, and Swarup (1972, 1978) and Swarup Et. Al., 1971, 1973. Similar results have also been obtained by Abraham and Desai (1976) in case of Tuberose where-

by they were able to induce chlorophyll changes in the leaf colour by 1.75 KR treatment of gamma rays and 0.5 KR for *Amaryllis.* However chlorophyll changes for leaf colour have not been obtained in the present study. It is thus evident that 0.5 KR of gamma-irradiation is the most promising dose for induction of mutation in bulb crop like *Amaryllis.* The vegetative changes observed as in case of delayed sprouting, stunted growth, curling of leaves etc., is supported by the work of Manning (1969) on irradiation of *Amaryllis* seed with 15 KR dosage. The increase in floret number to six as against 2-4 in the control as found in mutant No. 3 is suggestive of the fact that dominant changes can be brought about by 0.5 KR gamma-irradiation. The inheritance of this characteristic has been worked out by Bell (1977). He has on the basis of species hybridization suggested the floret number to be a dominant factor but which is not inherited as a simple trait. This gives a method for the improvement of this trait through the mutation breeding technique. Likewise similar results on the increase in floret and tepal numbers, fused flower, and increase or decrease of stamens numbers, were noted in irradiated populations by Abraham and Desai (1976).

SUMMARY

Amaryllis gracilis cv. 'Dutch Red' bulbs were exposed to gamma-irradiation dosages. Mutants for flower, leaf shape, colour and floret numbers have been obtained. 0.5 KR is most effective dosage for irradiation of bulbs. Three different mutants have been described, their florachromes studies which have brought out differences in their flower colour as shown by measuring optical density which was less in the mutants than in the respective controls.

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BREEDING HYBRID AMARYLLIS WITH 6-8 FLOWERS PER UMBEL

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In the 1920's new hybrid *Amaryllis* cultivars were imported from Europe and admired by many gardeners in Japan. In the past, the older kinds of *Amaryllis* hybrids had been grown for probably over century.

Fig. 18. **Allium giganteum** grown by Isamu Miyake in Japan for the cut flower trade under glass, in **background.** In **foreground,** Miss Miyake, holding giant many-flowered scape of pure white Miyake strain of Hybrid **Amaryllis.** Reproduced from Kodachrome color print.

A few leading gardeners hybridized the new cultivars to select and give Japanese names to superior clones by about 1940s, but due to the

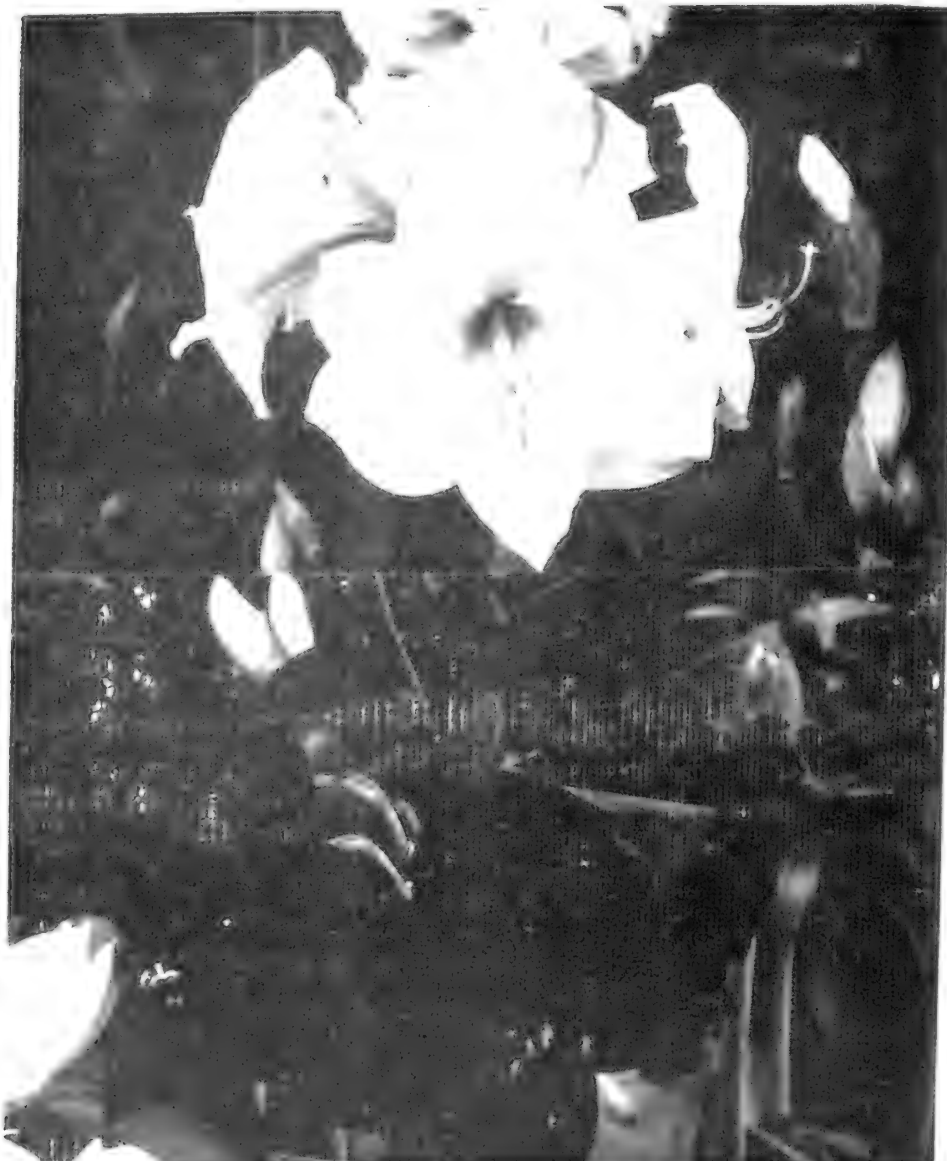

Fig. 19. The Miyake strain of many-flowered Hybrid Amaryllis Hybrids. **Top,** pure white hybrids, which reproduced well, and **bottom,** beautiful medium red hybrid, which did not reproduce satisfactorily, from Kodachrome color prints.

difficulties during the war nearly all of them have been lost.

In 1950s the amazing Ludwig's *Ameryllis* hybrids were imported from Holland and an agricultural station and some leading nurserymen started to grow them as a commercial item. Their activity however was not enough to maintain the people's fascination in *Amaryllis* and the collection of Dutch hybrids gradually disappeared from the nurserymen's catalogues. The cause of failure of the Dutch *Amaryllis* was that Japanese nurserymen tried to produce the bulbs in the open while they were plants developed under controlled greenhouse conditions rather than in outdoor fields. Infection of virus by careless handling also discouraged the industry.

At present those found in the market are old, pointed tepal strain hybrids and the Ludwig's strain. In far smaller quantity *Amaryllis gracilis* and *A. reticulata* are grown.

I have been growing *Allium giganteum* and others for cut flowers for many years and the *Amaryllis* has been one of the main items that grow. Several years ago it was my good fortune as I found a few clones among seedlings of Ludwigs strain which bear six to eight florets on a single scape, while, as everyone knows, almost all the *Amaryllis* cultivars bear up to four buds on a scape. The many flowering habit of my clones is quite stable, and it is truly a most luxuriant display when five to six, perfectly round florets, over 20 cm wide, of heavy substance open simultaneously. The scape usually exceeds 1 meter in hight, upright with usually two scapes per bulb that is prolific and vigorous. I have not named any of them yet, but the colors are pure white, brilliant red, salmon shade, striped and others. Being encouraged by the success I will devote more of my time to *Amaryllis* breeding. I shall *appreciate warm cooperation of our Society members through exchange of breeding materials* as I wish to extend my activity to such other categories of *Amaryllis* as *small flowering hybrids* differently colored hybrids and others that we *Amaryllis* hybridiers dream of.

A WELL-ROUNDED AMARYLLIS BREEDING PROGRAM NEEDED

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When one considers the range of types within the genus *Amaryllis* it becomes clear that breeders have taken a conservative approach to development. The trend in breeding over the last several decades has not brought a diversified product to the market. In fact the market has become so pointed that even the older American varieties are hard to come by. Today's commercially available Dutch material, while impressive in its own right, testifies to the fact that many delicacies of form in the wild species have been ignored. It is unfortunate for the consumer that such a state of affairs exists. On the other hand it leaves the door wide open for breeders with an eye for new forms.

Such an attitude on my part resulted from an increased awareness

of the genus. It has been some four years since I first became intrigued with the form and beauty of Amaryllis. My first exposure came while I was doing vegetable breeding research at Michigan State University. One of the people working on the project had set aside a portion of greenhouse bench to grow a few plants. During the month of March, Ludwig's Goliath and Peppermint Candy opened their buds. I was impressed to say the least. I obtained some offsets and followed the progression of these plants. As a result and quite by accident, I became totally absorbed in a new pursuit.

During the first two years I made a number of random crosses and grew a population of seedings from a self pollination. As one who from the beginning has been fascinated with genetic variability I was curious to see what segregating populations and crossed types might look like. In the past year that same interest and more knowledge of the genus has guided my efforts in a different direction. Currently I am making attempts to obtain as many of the species as possible so as to examine the range of types. So far I have obtained specimens of *Amaryllis aulica* from Thomas W. Whitaker and an interspecifle cross from William D. Bell.

The potentials for breeding programs in the future are many and one must narrow individual goals so as to engage in a manageable program. The first task might well be a familiarization with different germ plasm. The way to achieve this is to take up a collection of diversified forms. Aside from the physical restraints one can not over collect. Once a representative collection has been obtained it should be evaluated for potentially useable traits. Eventually a sound program with definite goals should be developed. Of course the breeder may take advantage of any unexpected results but sound strategy will increase the likelihood of success.

It would be premature for me to finalize my directions for the future. There are however a few projects which I intend to undertake. One is the development of new forms using *Amaryllis cybister. A. cybister* represents as extreme flower form with appearance similar to Sprekelia. At present I have only seen pictures of *A. cybister* but hope to locate a source soon. Wide crosses might yield many different flower forms in the F_2 populations. Selection for promising types and continued development could yield new and exciting lines of Amaryllis..

I have always been a little disappointed at the lack of fragrance in commercial Amaryllis. Part of the beauty of flowers for most people is the fragrance. Undoubtedly this lack is due to the fact that fragrance within the genus is not widespread and would have to be selected for. When the breeder is concentrating on blooms per scape, color and size, the additional selection pressure for fragrance would limit the selection process. At some point I intend to locate fragrant tetraploids to introduce this character into the large tetraploids.

Other areas of interest and possible work are the development of large vigorous yellow types, development of superior doubles, types that

flower at different times of the year, disease resistance, and cold hardiness.

It is my contention that while breeders have been at work for the last century, this field is still in its infancy. The key to the future certainly lies is the continued search for new germ plasm, the maintainance of already collected material, and the subsequent application of new ideas.

DWARFING FROM CHEMOALTERATION

Richard E. Tisch

Dwarfing of plants occurs sometimes from chemoalteration treatments. In several cases it was apparently only temporary, but in some cases its seems to have been permanent. In the temporary cases there were signs of dwarfing for two or three years, followed by a sudden change to vigorous leaf and flower scape growth that resulted in normal sized plants. In those cases which seem to be permanent, some plants exhibit very slow growth, and some grow vigorously. In the last instance, it seems to me more likely that true dwarfing has occurred.

My first examples of dwarfing were temporary. Some seeds of *Tulbaghia violaceae* were soaked in a colchicine solution for 48 hours, then planted normally. They were smaller than normal for two years and flowered on shorter than normal scapes. The third year of their growth they reverted to normal size in all respects.

The next experiments in chemoalteration were performed on seeds which had been given only a six-hour soak in the colchicine solution. In two years they began flowering, some with shorter than normal leaves and scapes. For clumps which had the shortest growth were alternately root-soaked in tap water and in colchicine solution six times, for approximately 24 hours in water and 12 hours in the colchicine solution. None of these showed any changes worth noting.

The final experiments included two batches of seeds, the first soaked in a colchicine solution for 48 hours, the second for nine days. That length of time was due to my absence from home while the seeds continued to soak. Of the first batch, none showed signs of dwarfing and were rogued out. Of the second batch, four showed distinct signs of dwarfing and were grown on for observation to their sixth year from sowing. Their status is as follows:

#1—24JUL78—Leaves 10 to 18 centimeters long; only nine individual plants (divisions); no flower scapes yet.

#2—24JUL78—Leaves 25 to 32 centimeters long; several large clumps from divisions; 35 scapes 50 to 65 centimeters long with 9 to 11 flowers per umbel; all flowers normal shape and size.

#3—24JUL78—Leaves 10 to 18 centimeters long; several medium sized clumps from divisions; nine scapes 39 to 42 centimeters long with 9 to 11 flowers per umbel; all flowers normal shape but slightly smaller

than normal size.

~~#4~~ 06MAY78—Leaves 20 to 25 centimeters long; four scapes 39 to 42 centimeters long with 9 to 11 flowers per umbel; all flowers normal shape but slightly smaller than normal size.

Another experiment in chemoalteration was performed on Tangerine seeds from a commercial fruit. Of 20 seeds soaked in a colchicine solution for 11 days, the four *largest* and fastest growing were set out in an outdoors bed. To my amazement, two of these then settled down to very slow growth; the other two were removed, and the two smaller ones were retained because of their obvious dwarfing. Today, seven years later, they are both smaller than would be expected. Neither has blossomed yet. One is only 1.2 meters tall and 1 meter in diameter through the leaves. The other is only 1 meter tall and 55 centimeters in diameter. The question in my mind is: what might have resulted if I had selected the smallest, slowest-growing seedlings?

The Tangerine trees have remained undisturbed, but the *Tulbaghia* have been reset twice, thus giving me a chance to examine their root growth. So far there is no evidence of "club-rooting" or other abnormal root growth, which has been seen in some other plants treated with colchicine. As noted above, leaf and flower growth is normal except for reduced size. In the smallest, the growth of flower scapes has not occurred over this long growing period.

These results suggest to me that we may have been making a mistake in rogueing out the slower-growing plants from chemoalteration experiments. In many types of plants, smaller variations would suit better the small backyard garden, such as mine. Perhaps even purposeful treatment toward achieving dwarfing would result in many plants more suitable for limited growing areas.

DELIGHTFUL **HYMENOCALLIS** HYBRIDS

T. M. HOWARD, *16201 San Pedro Ave., San Antonio, Texas 78232*

I. INTRODUCTION

When one considers the large number of species to be found in the genus HYMENOCALLIS, it is surprising that there are so few hybrids. There are several reasons for this. Except for a tiny handful of green or yellow flowered species, the overwhelming majority are white in color. Then there is the matter of form—a varied membranous staminal cup surrounded by six very narrow floral segments. Few breeders ever got beyond the stage of hybridizing a very few species, mostly of the South American group, in the subgenera *Ismene* and *Elisena*. To be sure, the effects produced are quite beautifully enchanting, but the surface has barely been scratched by the breeder.

Most of the early attempts were made in Europe (England and Holland). Dean Herbert likely was the first breeder for the group with his *H. spofforthiae*, a cross involving *H. narcissiflora* (white) with the yellow *H. amancaes*. The Dutch repeated this cross and the best of

these, 'Sulphur Queen.' is still cultivated. Another popular creation was 'Festalis', first conceived by A. Worsley, An Englishman, by crossing *H. longipetala (Elisena)* with *H. narcissiflora*. 'Festalis' is wonderfully orchid-like in its graceful beauty.

European breeders also spawned a couple of hybrids involving *H. narcissiflora* with *H. speciosa*. These were likely the first recorded crosses involving the Ismene section with the subgenus Hymenocallis. Two known hybrids resulted: 'Daphne' and 'Macrostephana'. Of these two, only 'Daphne' is known to still exist in cultivation. This is mostly due to the fact that 'Daphne' requires the same culture as *H. speciosa*, a greenhouse plant. Foliage of this hybrid is broad and nearly petiolate, and the flower only barely hints at the Ismene parent, though the cup is larger than that of *H. speciosa*, and there is good substance.

The late Cecil Houdyshel may have been our first modern American breeder for the genus. He duplicated 'Festalis' (which was later to be duplicated by others as well), and later developed 'Olympia' by backcrossing 'Sulfur Queen' onto *H. narcissiflora*. 'Olympia' indeed had a large flower, but had the drawback of being a poor propagator. The flowers were cream which quickly turned white. It is unlikely that the clone is still in the trade, since the passing of Mr. Houdyshel, but it is still in cultivation. The writers initial single bulb has increased to four or five with the help of injuring the bulb basal plate . . . over the span of some 25 years.

II. LEN WOELFLE HYBRIDS

In the nineteen fifties, the late Len Woelfle acquired an interest in this group and began his own breeding program, continuing this until his death in 1964. Len lived in Cincinnati, Ohio, a climate too cold for year-round outdoor culture of this fairly tender group, and thus had to grow his bulbs by the dig-and-store method. This laborious task was truly a labor of love. Len began by making crosses with *H. narcissiflora*, *H. amancaes*, and *H. longipetala*. He reproduced his own FESTALIS, and also made an interesting series of *H. x spofforthiae* crosses giving him near-duplicates of 'Sulphur Queen' . . . 'Pax', 'Helios', and 'Icon'. Of these three, 'Pax' was his best. 'Pax', the reciprocal cross, was lighter in color, but had an interesting, slightly different form. These plants have recieved very limited distribution, but still exist in a few private collections. In 1955, Len crossed 'Festalis' with *H. amancaes* and got a single seedling, 5504. This clone still exists and is unnamed due to being a bit disappointing. The color is sulphur-yellow as one might expect, but the form of the flower lacks the character of either parent. Far better was his 'Green Gold', a backcross of 'Pax' onto *H. amancaes*. This clone had the deep yellow color of the species, with much lime-green in the throat, giving it a most lively character. Unfortunately this lovely hybrid was lost in a digging accident one autumn. Perhaps someone will eventually attempt to reproduce a clone like it.

Len broke new ground when he attempted a series of crosses involving one of Mexican species of the Mexicana alliance obtained from Van Tubergen under the name of *H. harrisiana*. This species received wide distribution under that name, but there is some doubt if the identity is correct. *H. harrisiana* was crossed with *H. narcissiflora* and reciprocal crosses were likewise made. These were dubbed the "snowflake" series, and consisted of 'Diadem', 'Jack Frost', 'Snowflake', and 'Iceberg'. Of these, 'Diadem' was the most distinct of the group with dark green foliage. Alas it behaved badly and was eventually lost. The other three were rather similar, differing only in very minor details, all with the very sweet fragrance of four-o-clocks, a rotate cup of medium size, sterile yellow pollen, and foliage appearing much like the Mexican species, though more robust. They propagate well and are very easy

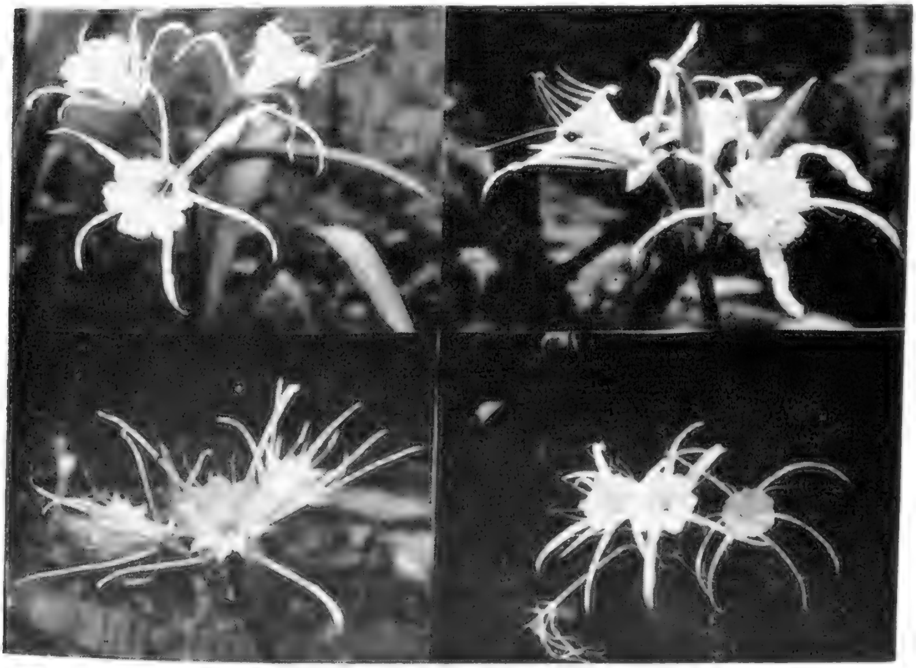

Fig. 20. Woelfle hybrid **Hymenocallis. Upper left and right**, Dancing Doll Series; **Lower left**, 'Buckeye'; and **Lower right**, 'Snow Flake'.

to grow. More unusual perhaps was his PIXIE CUPS, a cross of *H. harrisiana* x *H. longipetala*. These greatly resembled the "snowflake" series, save that the cup was a bit longer and more trumpet-like. Another dead-ringer for the snowflake series was oddly a disappointment owing to greater expectations from one of the parents. . . . *Eucharis amazonica*. Len swore that there was no mix-up in his pollinations or recording of this hybrid, but the result was exactly like the "snowflakes". No evidence of Eucharis in the progeny. The bigneric effect was lost by dominence of the *H. harrisiana* seed parent.

Len's last decade was spent in giving us his finest hybrids of which we still have two series in cultivation . . . the 'Dancing Doll' hybrids and his 'Buckeye' clone. The writer still has several of his "Dancing Dolls" in cutivation but most of them are too slow to propagate to receive distribution. Two clones, 'Ballerina' and 'Dancing Doll' have the extra vigor to propogate vegetatively. This series was Len's effort to obtain yellow flowered forms resembling 'Festalis', and in this he succeeded. Each clone was in itself very distinctive and uncommonly beautiful in the orchid-like form, the gracefully curving segments and the daffodil-like cup with delicately fringed edges. They varied in coloring from light yellow to cream. All of this came from the uniting of two species: *H. amancaes* x *H. longipetala*. Len correctly assessed that in order to obtain yellow flowered hybrids, one must rely on *H. amancaes,* and in order to otain the orchid-like gracefully curled segments, one absolutely had to depend on *H. longipetala*. Likewise, the delicate fringing of the cup is derived from *H. amancaes,* while the daffodill like trumpet effect steams from *H. longipetala.* Originally there were six clones, all differing in some minor details, each flowering at different times within the growing season, and with varying robustness. Choosing a favorite clone from this group perpetually stymied both Len and the writer. Each was smashingly lovely and distinctive in its own right. Eventually it remained for their propagating ability to decide. A couple of clones were lost during this time and it is a pity.

'Buckeye' was another winner, both beautiful and curious. It was Len's first attempt to cross the fantastically lovely *H. longipetala* with a native N. American species *H. liriosme* (Raff.) Shinsers. The latter is a Texas species with swamp-growing habits and which is best grown in cultivation under aquatic conditions. *H. liriosme* has several good characters that endear it to a hybridist not the least of which is winter hardiness into more northern climates. It flowers earlier than most species, has a nice rotate cup accentuated by a greenish-yellow center. The hybrid 'Buckeye' was the single survior of a sibling trio. all varying a bit in size, vigor, and minor details. It seems to unite the characters of both parents better than anything developed to date, but this is apt to soon change. 'Buckeye' has a daffodil-like look to the trumpet, with a greenish yellow center. The segments have a bit of graceful curving and curling to them. Alas the aquatic habits of *H. liriosme* are reflected in its hybrids, making them difficult to flower unless kept unusually wet during the growing season. Len experimentally proved that 'Buckeye' was hardy over winter at least to Southern Ohio.

III. **HYMENOCALLIS TRAUBII** HYBRIDS

For years after the death of Len Woelfle, the hybridizing of *Hymenocallis* nearly came to a stand still. The writer vainly attempted a few crosses in half hearted fashion, but was stymied by the inability to secure mature flowering size bulbs of the various South American species that might set fertile seed . . . *Amancaes, longipetala* and *narcis-*

siflora. Only the latter was in my collection and it rarely flowered for me and even more rarely produced any seed. Without the necessary species to work with there was no sense of direction. Then one day I flowered a bulb of *H. traubii* which Dr. Traub had generously given me, and I pollinated it with pollen from an unidentified species I had obtained from a Jacala garden in Mexico. The species was one of the tropical evergreen kinds with wide, dull green leaves . . . a squatty plant with a squatty bulb . . . rather large in every way. The habits of this species were interesting though, as it could produce 2-3 scapes is succession from largest bulbs, and the individual flowers were unusually large with tepalsegs half again wider than those of most species. This species still only bears the number 57-3 ''Jacala Garden'' for its identification. It is not known if it is even a native of Mexico as it has characters normally associated wth members of the genus found around the Caribbean region. When compared to this ''fatty''. *H. Traubii* is an exquisite miniature compact little plant with small narrow leaves and tidy habits. The flowers of *H. traubii* are stunningly large and showy, spanning about ten inches across, with a very large rotate cup. Its only fault is that the umbel is only two flowered. Apparently it tries to make up in size of flower what it lacks in the number of flowers in the umbel and size of plant. The cross between the ''fatty'' 57-3 and *H. traubii* was successful and seed was obtained. Two of these survived, and one clone has flowered several times. One clone has erect tapered foliage and the other has more spreading, bluntly tipped leaves. The first hybrid to flower of this series has in a short time proved to be outstanding. It propagates well, maintains an appealing tidy compactness, and reliably has two flowering seasons each year . . . late spring and again in late summer or early fall. This trait is most unusual for hybrids in this genus, but a welcome one. The flowers are large and well formed, with an attractively eye-catching rotate cup and well recurved tepalsegs. The bud count so far seems to be seven per umbel and the flowers seem to last longer than normal. So far the plant seems to be sterile. I have withheld introduction of this cross until I can flower its sibling and compare them. Certainly it now appears that *H. traubii* may possibly open doors to new kinds of hybrids having compact habits suitable for pot culture.

IV. ANOTHER CROSS

The writer has also successfully crossed *H. liriosme* x *H. narcissiflora.* There are two clones, neither of which has flowered although they are nearing maturity. Habits are intermediate, and this seems most promising, but they require more moisture to grow at their best and I have had to resort to nearly aquatic conditions to push them along faster. At this writing, it now appears that *H. liriosme* is compatable with the South American group, and a host of interesting hybrids should eventually emerge from this venture.

V. LUTHER BUNDRANT CROSSES

A new breeder from Texas has suddenly come forth with a host of new *Hymenocallis* hybrids that may make their mark on the Amaryllis World. Luther Bundrant has recently produced several series of hybrids involving a more complex approach. His first effort involved using the pollen of one of the "Dancing Doll" clones . . . PICTURE on *H. galvestonensis.* You will recall that the "Dancing Dolls" sprang from *H. amancaes* x *H. longipetala,* so potentially a variety of new characters were merged. *H. galvestonensis* is one of the hardiest species, but with deciduous glaucous foliage, and a sweetly scented flower having a rotate cup. All three clones flowered in 1978 and all differed in minor details in the flower but were otherwise similar. Poliar habits and differences were more marked. In spite of expectations, the Ismene-Elisena traits were dominated in the flower by *H. galvestronensis.* The white segs had a bit more curving to them, and the white cup seemed less rotate and a bit more "toothed", but this could not be confirmed at the time without seeing the flowers of both parents. Fragrance was sweetly lemony. One clone had dark green, narrow foliage with a basal "neck" like the South American parents, while the other two were sessile in leaf. The most rebust of the trio was judged the best, but it will take several successive years of flowering to finally decide.

Luther flowered another very different seedling hybrid in 1978, a cross involving *H. eucharidifolia* with 57-3 "Jacala Garden". This had flowers like *H. eucharidifolia* on a larger umbel. The bulb produced two scapes, like the "fatty" parent, but foliage was dark green and narrow. Although *H. eucharidifolia* is an interesting plant because of its relatively small cup, it really has little to commend it as a hybrid producer. The fact that the hybrid produced two scapes is due entirely to the Jacala 57-3 parent.

Mr. Bundrant has a duo of interesting siblings that should flower in 1979 or 1980 involving *H. tenuiflora* x *H. narcissiflora.* The writer collected the true *H. tenuiflora* in Guatemala in 1974, and it has strongly reflexing segments that dangle like ribbons. The cup is funnel form. It is obvious that the seedings are hybrid as they resemble neither parent. One can only speculate at this writing what they will look like when they flower.

More exciting perhaps are Luther's crosses involving *H. traubii* x *H. narcissiflora.* There are perhaps four of these and they all show intermediate foliar characters. That is, the leaf base forms a "neck" like the Ismene parent, but are deep green and miniaturized like the other parent. It is too early to speculate, but potentially these could be very good indeed. Luther has some young hybrids involving *H. liriosme* x FESTALIS. Oddly, these seem to lack vigor and may take a long time to mature.

VI. ADDITIONAL HYBRIDS

Two seedlings of hybrid origin have proved an enigma, though they are still a couple of years from flowering. A few years ago I

pollinated *H. galvestonensis* with pollens from two Mexican species . . . *H. glauca (H. choretis)* and *H. azteciana.* Seed was secured from both crosses, but many seedlings died and labels got lost. Two seedlings survive and they are fall growing. This is strange indeed, as none of the parents have this strange habit. Both seedlings remain dormant throughout the summer, refusing to grow in spite of coaxing until September. They then go into dormancy before winter. Foliage is petiolate on one and subpetiolate on the other. In typical Mexicana-alliance-fashion only a few leaves are produced. They will only likely be of value to a few, owing to their weird habits. This may be explainable to the mis-matching of the unique growing habits of their parents.

Jim Bauml made a cross that at first promised a good deal when he pollinated *H. fragrans* x *H. nayaritiana. H. fragrans* has many similarities to *H. speciosa,* so the potential was inviting. Alas. The seed failed to germinate and eventually shriveled after a year of trying to tempt it to put forth a radicle. It was a failure but one is tempted to see if it might not work again.

Dr. Traub created his own hybrid 'La Jolla' by crossing *H. narcissiflora* x *H. vargasii.* The latter belongs to the subgenus *Psuedostenomesson* and is unusual in this group because of its pendulous green flowers. 'La Jolla', however, has upfacing flowers in white, with only a hint of green. One can only speculate as to what other combinations of *H. vargasii* with things like *H. amancaes* or *H. longipetala* might spawn.

The writer would be negligent if he failed to mention the many hybrids made by Glen Moore at the U of Chicago in the early fifties. At that time Mr. Moore was studying seed respiration of Hymenocallis and had acquired a sizeable collection of species from many sources. When he completed his graduate work, he left and took his plants with him to Utah. I have not heard from him since and can only guess that they no longer exist. He never published his crosses and it is possible that he failed to flower them all. I recall that he had several pots of hybrid seedlings involving *H. speciosa.* But there were many hybrids involving tropical species mostly.

I nearly forgot to mention a couple of additional Ismene-type hybrids of European (Van Tubergen) origin. Van Tubergen is currently listing a variety of 'Festalis' called "Zwanenberg" which they consider an "improvement". I have not yet seen it. It may be either a backcross onto *H. longipetala* or more likely a sibling selection. ADVANCE is certainly a backcross of 'Festalis onto *H. narcissiflora.* It too was dubbed an "improvement", but I find it difficult to flower here, although it has vigor and grows well. This is an "Improvement" of doubtful value.

As we have seen, because of the very large number of species, the combinations are nearly endless. They can be wretchedly restrictive as to color choices, and to some degree to size and shape of tepal-segs. They will always have long narrow segs, unless by some miracle someone discovers an exception to this rule. Until that day it is foolish to

speculate about broad petals. The best the breeder can alter is their position with relation to the dup. They can recurve, incurve, spread, or curve alternately.

The cup is quite another matter. Changes in the cup can be more spectacular and rewarding. Some are funnels while others are saucer-like (rotate). Some are quite tiny and others are relatively large. The breeder will favor those with the showiest most prominent cups. The tepaltubes might be of consideration, but to a much lesser extent. Some species have short tubes and others long tubes, and to a degree this will affect the appearance of the umbel display. Most tubes are straight, though a few species have curved tubes. I seriously doubt a breeder would select a given plant for breeding based soley on the tube however. The staminal cups may be toothed or fringed to a greater or lesser degree, depending on the species. This "toothing" occurs between the filaments along the cups edges. *H. amancaes* is beautifully fringed and this is reflected in hybrids like 'Sulphur Queen' and the various 'Dancing Doll' series. Substance in hot weather is a good factor among the species. Some hold up better than others do in heat. A high bud count in the umbel is preferable to a low bud count. Plants such as *H. floridana* and *H. traubii* are hampered by low (two) bud counts. Hybridizing improves this if wisely done. Some species are rigid as to special cultural requirements, and this can be improved through hybridization. Then there is always the matter of the foliage. Some species have foliage that is very ornamental, and this can be a by-product in a good hybrid. Hardiness to cold in the native N. American species is appealing for hybrids. Miniature species are desirable for hybrids intended for pot culture or where space is limited. As for color, we only have yellow in the form of *H. amancaes* available to do much with. Basically, you may only have white species to work with, so make the best of it. The serious breeder will want to have not only the yellow *H. amancaes*, but also *H. narcissiflora* and *H. longipetala* in the South American species. There are other species, but these are not available commercially. After that, one must choose with whatever species are available. Breeding Hymenocallis can be a challenge but often the effort and time invested can be worthwhile.

CORRIGENDA—continued from page 4

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Page 128, under **POLIANTHES X BUNDRANTII I. M. HOWARD. SP. NOV. FIG. 23,** for "SP. NOV.", read **"HYBR. NOV."**

Page 129, for **"Pediceles"** read **"Pedicels",** and under line 6, for "4-5 cm wide" read "4-5 mm wide." In next paragraph, lines 4-7, "They began germinating etc." read "Germinating in nine days; by the 13th day half had germinated. Nov. 30, 1975. Seedlings were planted in a medium of sand, peat moss, and oak leaf mold on April 24, 1976."

Page 64, first line, for **"HYMENOCALLIS QUERREROENSIS"** read **"HYMENOCALLIS GUERREROENSIS".**

PLANT LIFE LIBRARY—continued from page 42.

PHYTOSOCIOLOGY, edited by Robert P. McIntosh. Academic Press, 111 Fifth Av., New York City 10003. 1978. Pp. 388. Illus. $24.50.—This volume is concerned with phytosociology, the interrelationships of species of plants in space. After considering the history, concepts, terminology, research papers by outstanding authorities are presented in the fields of selected vegetation studies; ordination and numerical classification; and recent perspectives. Highly recommended.

MAKING THE MOST OF YOUR GREENHOUSE, by Ian Walls. Barron's Educational Series, 113 Crossways Park Drive, Woodbury, New York. 11797. 1978. Pp. 95. Illus. American Edition, paper $3.36. Author Walls characterizes the greenhouse as a devise for overcoming the vagaries and limitations of an uncertain climate and enabling the avid gardener to "raise and grow plants which would fail altogether out of doors, or else be very slow to develop." This concise manual details the lighting, heating and cooling of the greenhouse; watering, feeding and staging plants; choosing soil mixes and propagation of plants. Highly recommended to all beginning greenhouse owners.

THE CARPET GARDEN by Renee and Stave Rockmore. Thos. Y. Crowell, 10 E. 53rd St., New York City 10022. 1978. Pp. 123. Illus. Cloth, $10.95; paper, $4.95. Subtitled, "No-work Vegetable Gardening for less than $5.00," the authors describe their use of durable indoor-outdoor carpeting as a mulch, depending on the carpet's insulative quality to retain moisture, and to protect ground surface, and the elimination of weeding. Complete planting instructions are given for planning, preparing, planting and harvesting.

GARDEN PLANNING AND PLANTING by Eigel Kiaer with Hans Peterson. Sterling Publ. Co., 2 Park Av., New York City 10016. English Edition. 1976. Pp. 222. Illus. This is an adaptation of an outstanding Danish text to British conditions, dealing with the choice of garden style, and the selection of plants for the garden. The text is outstanding for the profuse illustrations in color. Highly recommended.

FOREST MICROCLIMATOLOGY, by Richard Lee. Columbia University Press, 562 W. 113th St., New York City 10025. 1978. Pp. 276. Illus. $17.50. This outstanding book is concerned with the microclimatology created by forests, with reference to the atmosphere, biosphere, radiant energy, sensible heat, latent heat, metabolic energy, energy budget, microclimate, and problem types. Highly recommended.

SUNSET BOOKS PUBLISHED IN 1978. All edited by Editors of Sunset Magazine and Sunset Books. These may be obtained from Lane Publishing Co., Menlo Park, Calif. 94025. **All are soft cover, and profusely illustrated.** Highly recommended.

LANDSCAPING AND GARDEN REMODELING. Pp. 80. $2.95. Gives directions for planning the garden you want; combining plants with structures; when your yard needs remodeling; and selecting your basic plants.

PLANT LIFE LIBRARY—continued on page 116.

4. AMARYLLID CULTURE

[ECOLOGY, REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

GENERAL AMARYLLID REPORT - 1979

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During the past year I have obtained more amaryllids than in any previous year. These came from such diverse sources as local nurseries, government agencies, botanic gardens, amaryllid collectors throughout the world, and wild collections. In this report, I will discuss some of the species acquired this year, and will touch on their descriptions, and cultural requirements.

Crinum pedunculatum R. Brown. This species was obtained from two sources. The first plants came from an Australian amaryllid nursery. Plants received from this nursery were presumably originally collected in their native Queensland habitat. A remarkable feature of this first accession is the ratio of leaf length to leaf width. The amazingly long (proportionately) leaves remain erect, however. The second group of plants of this species were collected in their natural habitat on islands of the Torres Strait, off the northern coast of Queensland. Of this second group, one of the plants had the much-reduced bulb typical of the *Crinum* species allied to *C. asiaticum*, while another smaller specimen exhibited a definite, globose bulb. Time will tell whether these both are correctly-identified.

Crinum pedunculatum has been reported from such areas as Eastern Australia, Timor, Fiji, New Guinea, Tahiti, and Lord Howe Island. It is very closely related to *Crinum asiaticum*, and possibly should not be given separate specific rank from that species.

This species responds well to a sandy soil mix, with organic matter added. It is suitable to the large, warm greenhouse, and outdoors in tropical, and subtropical regions. In Queensland, it is noted for its hardiness but it should be considered that Queensland extends far into the tropical zone.

Cyrtanthus herrei Leighton. This succulent species was formerly classified as a *Cryptostephanus*, a much confused genus, which could use some work. It is closely allied to such species as *Crytanthus carneus*, *C. falcatus*, and *C. obliquus*. This is probably the largest species in the genus, the heavy leaves eventually topping two feet. Leaves are gray-green in color, typical of many plants from arid, or semi-arid regions. The plant is native to Namaqualand, in South Africa.

This species should be grown as a succulent, with special attention paid to providing a loose, sandy, fast-draining mix. Roots may quickly rot in water-logged soil, especially if the soil has not been sterilized. It will tolerate full sun in most areas. This species has not yet flowered for me, probably because I have had to transplant it several times due

to root rot. It has now settled down to my present mix, and hopefully flowers will be produced next year. The inflorescence is said to resemble *Cyrtantus obliquus,* only much larger. The leaves of *C. herrei* have the habit of gradually dying back from the tips. After much experimentation, I have decided that this is a natural phenomenon, characteristic of the succulent Cyrtanthus species, as well as several other genera of South African amaryllids; *Crinum, Ammocharis, Nerine,* etc. Some leaves may be expected to exhibit this burning at any given time, although the plant will remain evergreen. This species, like most amaryllids should probably be given reduced watering during part of the year, in this case winter. The four species of *Cyrtanthus* mentioned in this section are the best in the genus, in my opinion, with *C. herrei* standing above the rest, literally.

Hymenocallis macrostephana Baker. A large bulb of this species was obtained from cultivation in Hawaii. While in Hawaii I spotted a large clump of an *Hymenocallis* species growing in a shaded corner of a botanic garden. Closer examination revealed that these plants were labeled as *H. macrostephana.* Many had thought this species to be extinct but it had always been a plant that I had wanted to obtain.

It was suggested by J. G. Baker that this plant could be the hybrid between *H. narcissiflora* and *H. speciosa* mentioned by Herbert. This remains to be seen. The Hawaiian plants originally came from a European botanic garden but little information is available about them other than this.

My plants fit Baker's description of this species well, at least as far as the foliage. I am still waiting for the flowers, which might appear this winter. Leaves are petiolate, with broad blades. They are very similar to those of *H. speciosa* but they are much shinier. As in *H. speciosa,* the leaves are produced at one time (usually in late summer), instead of throughout the year. This characteristic distinguishes *H. speciosa. H. macrostephana,* and perhaps *H. fragrans* from most other *Hymenocallis. Hymenocallis macrostephana* produces a large, white, sealy bulb, with a pronounced neck. The plant is evergreen in habit. In general. it would appear to fit the Speciosa Alliance much more closely than it would subgenus Ismene.

Hymenocallis macrostephana is of easy culture. A loose, sandy, but rich mix suits it well. It seems to require less water than *H. speciosa,* and may tolerate more light, and lower temperatures. It should be regarded as a tropical, humidity-loving species, however.

Efforts will be made to self-seed this species in an attempt to determine any hybrid background. In the meantime, it will be propagated by offset.

Sprekelia formossisima forma williamsii Traub. A plant of this form was obtained, and flowered. It produces a huge, crimson flower. among the most singularly spectacular of the family. The form is larger in all its parts than the typical *S. formossisima.* Leaves are about 1½ ft. tall, and are bright green. This semi-evergreen plant produces leaves throughout the year. It spreads quickly by offset.

Any good amaryllid mix can be used. The plant probably would do best in full sunlight in most areas, although it will also flower if given afternoon shade. Two scapes were produced, each about 22 inches tall. The second flower was self-pollinated. The resulting capsule produced around 120 seeds. A very high percentage of these were fertile, and they germinated in a matter of days. After about four months, the seedlings are around eight inches in height.

Sprekelia formossisima f. *williamsii* is the best *Sprekelia* I have seen. There are many forms of *Sprekelia* I have yet to see but I don't believe any of them could surpass this form as flowering plants. The *williamsii* form has been considered quite cold tolerant for a *Sprekelia*. In this region there is no way to test its limits but those growers in northern states may wish to try. Better yet, in northern states, treat it with "gladiolus culture".

Hymenocallis littoralis "Variegata" (syn. *H. pedalis* var. *variegata*). This tropical plant is the most beautiful *Hymenocallis* in foliage, and that statement may apply to the whole family. The leaves are strongly striated with creamy yellow on the edges, while the dark green dominates the center of the leaves, the center also being pinstriped with yellow. The variegation tends to be much more uniform than that of other variegated amaryllids, *Amaryllis reticulata* var. *striatifolia* excepted. I am still waiting for its flowers but they are equally beautiful, with very long tepal tubes.

This is another amaryllid that is best suited to the warm greenhouse, or outdoors in tropical areas. It is not fussy as to soil, and can tolerate considerable light. Being evergreen, moisture should be provided at all times. The plant does not seem to go through any dormant period.

The nomenclature of this species is confused. This plant is widely grown in the tropics, throughout the world but I have not determined whether it has been collected in the wild. Efforts will be made to compare this species with wild collections of *Hymenocallis littoralis* and *H. pedalis*. The latter species is particularly nebulous, while many plants masquerade as the former species. These two species, as well as many other *Hymenocallis* species need to be straightened-out taxonomically.

Eurycles amboinensis Loud. (syn. *E. sylvestris* Salisb.). The outstanding feature of this species is its very broad, cordate leaf blades, and long petioles. The plant has a decidedly aroid appearance, rivaled only by subgenus *Eucharis* of *Urceolina*. It is interesting to place this species next to a linear leaved amaryllid, such as *Zephyranthes*, to see the variation which can occur within a family of plants. *Eurycles amboinensis* produces attractive, white flowers, which may be considered bonuses. It is outstanding alone, as a foliage plant.

For some people this species has behaved as an evergreen in some years, and as a deciduous plant in other years. I don't believe water should ever be withheld for any extended period. Care should be taken if the plant does lose all its leaves, since the last leaf will drop off, leaving a cavity on the top of the bulb. At this time, overhead watering should be avoided, or else the grower risks rotting the bulb.

This species has been troubled by burning of the lip tips and margins. This condition may be due to the high Ph level of the local water supply. I have recently discontinued the use of garden loam, slow-release fertilizer, and local water on this species, and several other plants which have developed the leaf burn.

Eurycles amboinensis is native to the Philippines, the Malay Peninsula, the East Indies, and Queensland. Differences in leaf shape may occur from these areas.

Crinum asiaticum L.—striated form. A plant of this form was obtained from the U.S.D.A. It has been collected in the wild in New Guinea. Striated Crinums, usually described as *C. asiaticum*, are grown ornamentally in other areas in the tropics, including the Philippines, Hawaii, and Singapore. Some variation exists in the striation of these plants, and they have not been identified thoroughly, although they tend to be typical asiatic species.

My specimen will have wide, white striations on some leaves, while other leaves will be almost all green, with the margins striped white. Some leaves will be both pin-striped, and have wide striations. Unlike the typical *Crinum asiaticum* this plant produces many offsets, the offsets being just as variegated as the mother bulb.

In New Guinea, only two or so Crinum species have been described. A recent letter from a contact in Papua New Guinea revealed that efforts were now under way to train plant collectors in that country. Hopefully, collections of previously described *Crinum* species, as well as discoveries of new *Crinum* species will be made.

The variegated *Crinum asiaticum* responds to typical *Crinum* culture. I require a moderately-heavy, moist soil. I have not had a chance to test its humidity requirements, since it has only been grown in the greenhouse. It may be assumed that it requires warmth at all times, high humidity, and moisture. In the tropics it makes an excellent specimen plant, eventually forming large clumps.

Clivia gardenii Hook. (syn. *C. gardneri* Hook.). Plants of this uncommon species were obtained from South Africa. It has been described from Natal, the Transvaal, and Swaziland but I believe its native habitat may only be in the latter country. It is listed in R. H. Compton's *Flora of Swaziland* as a saxicolous forest-dweller, growing in shade. *Clivia gardenii* may be added to the small list of epiphytic amaryllids. All Clivias could possibly grow under epiphytic conditions. *Clivia caulescens* has been regarded as an epiphyte since its discovery. Yet, the root systems of *Clivia caulescens*, and *C. gardenii* do not differ to any extent from the root systems of other *Clivia* species. The thick, finger-like roots of Clivias are reminiscent of orchidaceous epiphytes.

Clivia gardenii appears to be intermediate between *C. miniata* and *C. caulescens* in general habit. It has a short pseudostem, formed by leaf bases, not unlike that I have seen in some plants of *C. miniata*. The short stem is by no means as pronounced as that found on mature plants of *Clivia caulescens*. The leaves of *C. gardenii* are about 1½ ft. long,

dark green, lorate, and acutely-tipped. The inflorescence is pendulous, as in *C. nobilis*, and *C. caulescens*.

This species is a prize for collectors of rare amaryllids. It is of more value from a botanical standpoint than from a horticultural standpoint, however. A mix of two parts good quality loam, one part organic matter (I use redwood shavings), and one part fine sand suits this species, and other Clivias well. I have also had good results with lighter mixes for Clivias, such as the loose mixes used for *Amaryllis*. Shade is essential, and the soil should be kept moist. This evergreen plant is a strong grower, eventually forming large clumps.

Clivia sp. "Striata". The last species to be described in this article is certainly not the least. In fact, all of the plants mentioned so far, are among the best amaryllids from an ornamental standpoint. Plants of Clivia sp. "Striata" were obtained from a local nursery. It is quite rare. The horticultural/botanic history of this plant is confused. Whether it is of hybrid origin or not, remains to be seen, although the suspicion is that it is a hybrid. In the past, it has been regarded by some as a variety of *C. miniata*. This form is cultivated widely but not in quantity. It is grown in such diverse areas as Japan, Rep. of South Africa, and Europe, as well as a few places in this country.

The leaves of *Clivia* sp. "Striata" are dark green, striped with yellow. Leaves vary considerably as to amount of striation, and the variegation is not uniform as in *Hymenocallis littoralis* "Variegata". One wonders if the variegation of this Clivia is virus-induced. Otherwise, the plant is not unlike *Clivia miniata* in habit.

This evergreen plant will grow under conditions mentioned earlier for Clivias. Care should be taken to prevent the burning of the leaves by bright sunlight. The only pests present in the nursery soil were millipedes. These may be eliminated by drenching the soil with Diazinon. Millipedes generally feed on organic matter in the soil but may attack roots. As in other Clivias mealybugs may be expected to be a problem in the future. Malathion controls them.

LITERATURE CITED

Baker, J. G., 1888, *Handbook of the Amaryllideae,* 216 pp., London.

Compton, R. H., 1976, *The Flora of Swaziland*, Journal of South African Botany, Supplementary Volume No. 11, 684 pp., Kirstenbosch, Rep. of So. Africa.

ADDENDUM - SOURCES OF REPRINTS AND COLOR PRINTS

1. Lubrecht & Cramer, Booksellers and Publishers, 152 Mountainside Dr.—This is the warehouse address Randolph, N.J. 07801 or RFD 1—Box 227. —This is apparently the headquarters address Monticello, N.Y. 12701.

Offer the following reprints:

a. Baker, J. G., *Handbook of the Amaryllideae*—$16.00
b. Herbert, W., *Amaryllidaceae . . . and a Treatise—on Crossbred Vegetables,* with an Introduction by Hamilton P. Traub.—$64.00

On both of these books, a 15% discount is available if the purc
has spotted one of the publisher's ads. This company offers many
rare books. They also have Baker's *Handbook of the Irideae,* an
Flora of Mauritius and Seychelles, among others.

2. Pomona Book Exchange, Rockton, Ontario, CANADA LOR

This rare book company offers Redoute prints from *Les Lili*
at $4.20 each. The prints are 21½ X 14¼ inches. Amaryllid p
include:

(a) "Amaryllis curvifolia" *(Nerine sarniensis* var. *curvifolia*
your former article in *Plant Life)* (b) "Pancratium speciosu
(Hymenocallis caribaea) (c) *Hemerocallis caerulea* (I haven't chec
this one as to the correctness of the nomenclature). (d) *Narcis*
tazetta.

I imagine that they might offer other amaryllid prints from time
time. I know *Crinum erubescens* was printed in this series. This co
pany also offers prints from this series of species in such genera as I
Lilium, Polianthes, and Tulipa.

3. I have recently found one other source of Redoute prints. I ha
written them for their list, and will publish full information wh
available.

1978 ZEPHYRANTHEAE REPORT

Marcia C. Wilson, *Chairperson, Zephyrantheae Committee,*
255 Galveston Road, Brownsville, Texas 78521

SPREKELIA

General interest in this monotypic genus seems to be at a low point. A representative of a large distributor of bulbs said that his company used to sell several thousand bulbs of *Sprekelia formosissima* each year, but could probably use no more than several hundred now. As bulbs go today, *Sprekelia* are not very expensive and they are available both wholesale and retail from several well known commercial sources. If it isn't availability and price, part of the reason could be quality of product. This spring I ordered well over a dozen bulbs from each of two different sources. Having seen only bulbs grown by my mother and other members of APLS, I was rather appalled at the commercial product. The first group to arrive were extremely dehydrated, split into many groups of small bulblets and full of mealy bug. Despite their appearance, 20% managed to bloom once. The second shipment, also with mealy bug, looked a little better but refused to bloom at all. No wonder interest is low. This represents quite an investment.

Using stored pollen of 'Harrison's Orientred', some seeds were obtained from the few blooms. If bulbs will cooperate, my mother and I plan a campaign to improve some of the commercial product. We have 'Peru', 'Orientred' and hybrids of these two strains. Seedlings will include back crosses for flower quality and gradual introduction of other strains such as *williamsii,* commercial 'Superba' and hopefully

some various wildings in the future. Pollen seems to store as easily as *Amaryllis* in the refrigerator. Few *Sprekelia* will set self seed, but most any other *Sprekelia* pollen will do the job. In Brownsville, pollen normally matures by noon of the first day and the stigma is receptive in late afternoon. We missed pollinating one evening on a stray bloom and we were lucky to get seed from pollination early the next morning. Flower life is short with this genus. Collect pollen as soon as it matures and plan to watch the stigma carefully.

Fig. 21. X **Sprekanthus cagei** as flowered by Marcia C. Wilson at Brownsville, Texas.

X SPREKANTHUS

X *Sprekanthus cagei* bloomed for the first time in Brownsville this year. I had forgotten how gorgeous this diminutive Sprekelia-like

flower is, with its very broad petals, good substance and unusual claret color. (See photo) This slight tinge of purple is the major clue of hybridity with *Habranthus robustus.*

In a letter to Dr. John M. Cage, hybridizer of X *Sprekanthus cagei,* I asked for an update on culture of this bulb. He replied that optimum handling is not known. It will bloom in a pot if kept cool in the summer and almost dry in the winter. Large mature bulbs, stored dry in winter, have bloomed for him when planted in April.

I have always grown X *Sprekanthus* in the ground, undisturbed throughout the year, except the year I moved from Galveston. As a pot plant it was neglected and did not prosper. Since a mature bulb has bloomed twice in Galveston and once in Brownsville, perhaps I can guess at some optimum growing conditions, knowing when I failed to provide some. If your climate allows, grow the bulb in the ground all year: sandy, well drained soil with humus added, morning sun or filtered light. Feed and water *regularly* and try to maintain a pH close to 7 during the warm growing season. In cold climates, dig and replant in a fairly deep pot. Do this well in advance of first frost, to allow disturbed roots to reestablish. Do not fertilize and reduce water for 3 or 4 months, but do not allow roots to go completely dormant. In April, place the pot in a warm sunny location where it may receive some rain. As soon as the soil has warmed sufficiently, replant in the ground.

The best growing weather for spring flowering amaryllids in extreme southern climates is frequently from mid-August to December. *H. robustus* is one of these. It is also one of the rain lilies that grows and blooms best in the ground. It will bloom in a pot, but rather poorly. (My mother would disagree with this for uninvited seedlings thrive anywhere in her yard.) Without a hard frost or freeze, it does not lose leaves until late winter or very early spring. Roots are maintained throughout the year. First spring bloom is usually without leaves, which normally begin to appear in late May. X *Sprekanthus cagei* follows the growing pattern of its pollen parent *robustus* very closely. If the bulb is large and content, it will bloom several times each season and gradually offset. With no garden space available, let these bulbs share a large container with a foliage plant that likes good drainage and morning sun.

HABRANTHUS ROBUSTUS 'RUSSELL MANNING'

In *Plant Life* 1973 (page 50), the late Alek Korsakoff wrote of a seedling clone, X *Sydneya casterlyi* 'Russell Manning'. These notes had been written in 1972, before cytological results had been received. I had sent several offsets of this seedling group to Dr. Walter S. Flory at Wake Forest University. (The 'Russell Manning' clone was sent later and was not studied at this time.) Mr. Korsakoff had become extremely ill and had asked his wife, Meta, to send me all the seedlings grown from this capsule, a hybrid attempt of *H. robustus* x *Z. grandiflora* made by Russell H. Manning of Spring Valley, Minnesota. What a disappointment it was when Dr. Flory wrote that their study showed the somatic chromosome number to be 12, the usual number of *H. ro-*

bustus and too low to possibly be a hybrid with a *Zephyranthes*. To soften the blow of the chromosome results, Dr. Flory had written: "This is a very superior strain of *H. robustus*."

All of these seedlings, planted in the ground in Galveston, formed large clumps and bloomed profusely. Flowers were all larger than regular *H. robustus* I had bloomed from various sources, with deeper color and a slightly different form. I had sent the mother bulb of 'Russell Manning' back to its hybridizer and the offset I kept was one

Fig. 22. **Habranthus robustus** clone 'Russell Manning' as grown at Brownsville, Texas by Marcia C. Wilson.

season behind the other group. By the time it formed a clump and caught up with the others, there was no doubt that this clone was an extra special one from a new and different strain. Mr. Korsakoff did not exaggerate one bit.

H. robustus can be extremely variable in size and color shade or marking. Even flowers from one bulb can vary during the seasons. Superior qualities of this seedling group and *H. robustus* 'Russell Manning' do not deviate. Flowers appear to be twice the size of other strains. If a large number of regular flowers were available to compare, it would beat the largest by at least 1/3. This is not a fish story! This special clone sets seeds as readily as any other *robustus*, but I have not raised seedlings. It originated from bulbs collected in the wild by Dr.

Carlos Gomez Ruppel in South America.

Dr. Flory continues to enjoy the special 'Russell Manning' clo In a letter of July 18, 1978, he wrote: "We went over these fair carefully this spring and the somatic number is 12 - just as in the reg lar species. It has such gorgous large flowers that we suspected it being tetraploid, but apparently not."

1979 ALSTROEMERIA COMMITTEE REPORT

Donald D. Duncan, *Chairman, Alstroemeria Committee,*

P. O. Box 238, Sumner, Washington 98380

I was fortunate this past summer in being able to visit two green house ranges where Alstroemerias are grown commercially. Both are located in California, south of San Francisco.

It was a bright, sunny afternoon when I drove into the parking lot of Westland Nursery outside of Pescadero. Mr. Henry Mulder, whom I had contacted earlier when planning this trip, was on hand to greet me and take me on a personal tour of the facilities. We first entered the greenhouse range which covers 140,000 square feet with approximately 20,000 square feet devoted to Alstroemerias and the rest divided among well grown freesias, fuchsias and carnations. Although the *Alstroemeria* hybrids reach their production peak in May, there were still many flowering stems showing on this Friday, the 2nd of June. The stems of some varieties reach a height of seven feet! This makes them rather difficult to harvest Mr. Mulder stated. Most of the varieties, however, grow no more than five feet tall, a much more manageable stem length.

Our last stop was the large grading room where women were busy bunching alstroemerias. Westland Nursery puts ten stems to a bunch and runs three different grades. After the flowers have been graded and bunched, they are placed in water and taken into the large coolers where they are held prior to shipping. Mr. Mulder stated that they sell all of their flowers to brokers who then dispatch them throughout the country.

After thanking Mr. Mulder for taking time from his busy schedule to show me around, I continued down the beautiful Californian coast to Watsonville. Here I would visit the Florival Greenhouses Saturday morning.

I was delighted to have a little time to spend Friday afternoon looking around this charming city. I shall long remember a large "crisp" planting of white and blue Agapanthus swaying on their long stems in the warm afternoon breeze. What a sight for those of us who live in areas too cold to grow these beautiful flowers out-of-doors.

Saturday morning turned out to be cool and overcast as I headed out of town toward the Florival Greenhouses. Both Mr. and Mrs. Ben Graust and their daughter were on hand to greet me. To my surprise,

the Graust's had met each other and married while they were both employed by a greenhouse firm in the Seattle area of Washington. Later they moved to Watsonville and started their own business.

The total greenhouse range is smaller than that of Westland Nursery and the area devoted to *Alstroemeria* is roughly 7,500 square feet. Mr. Graust has been growing Alstroemeria for approximately seven years and finds them to be a very satisfactory and profitable crop.

After cutting, the flower stems are separated into two different grades, bunched, and placed in a walk in cooler. Mr. Graust also sells his flowers through a broker.

Fig. 23. Wholesale growers of Alstroemerias in California. **Left,** Mr. Ben Graust, Florival Greenhouses, Watsonville, Calif.; and **right,** Mr. Henry Mulder, Westland Nursery, near Pescadero, Calif.

Other crops of interest were *Gerbera, Stephanotis, Asparagus retrofractus, Asparagus medoeloides,* and *Eucharis grandiflora,* with snapdragons grown as a quick fill-in crop.

Both men grow *Alstroemeria* hybrids which has been developed by the Van Staaveren firm of Holland. Under an agreement with Van Staaveren, the grower can not increase the total number of plants he grows beyond that of the original purchase. Nor can be sell or give

plants away. Through this agreement the supplier prevents the market from becoming flooded with their hybrids.

Both men have used additional lighting to try to bring the plants to flower earlier in the spring. Mr. Mulder stated that he found that there was a definite response to additional light, while Mr. Graust said that he felt it had had no effect at all on his crop.

They did, however, agree that the first crop peaks in May and that a second but lighter crop can be harvested about September.

Mr. Graust stated that transplanting of the Alstroemerias must be completed no later than October or many of the plants will die.

Other than the usual greenhouse pests, aphid, white fly, and red spider, Alstroemerias seems to have no unusual pests or diseases. Mr. Graust did point out that an oil base spray should be avoided as it stains the flowers.

I again wish to thank both Mr. Henry Mulder and Mr. Ben Graust for taking time to show me through their fine greenhouses and for patiently answering all of my questions.

NORTH MIDLAND REGIONAL REPORT - 1978

JAMES E. SHIELDS, *Regional Vice-President*

A good response came back from my request to members of the A.P.L.S. from the Northern Midwest Region for reports on their other-vations in growing amaryllis in our region. Several respondents were overly modest about sharing their experiences with "the experts". I fear they have *under*-estimated their own expertise and *over*-estimated that of the rest of us in the A.P.L.S. I hope we can have a much wider participation in the next Regional Report to come out of the Northern Midwest. I note that many members are eager for communication with fellow growers of amaryllids. You need only write to one or two authors of articles in PLANT LIFE to soon find yourself in touch with many, many others of similar interests.

Mr. Donald F. Tunison. 9910 McCauly Rd., Cincinnati, OH 45241, is growing hybrid Amaryllis from seeds, and is tackling *Worsleya rayneri* from seed, too. He starts his seeds in small plastic pots under lights in his basement, graduating them to larger pots out in his garden as they mature. Growing amaryllids under lights may well be the central theme for most residents of this Region. The following contribution from Mr. Walrafen makes this point most tellingly.

GROWING AMARYLLIS UNDER LIGHTS

G. W. Walrafen
1215 Romayne Drive, Akron, OH 44313

I am an amateur Amaryllidarian. All of my experience is limited to growing Ludwig bulbs under fluorescent lights. I bought Ludwig's "Ace" about 6 years ago and had my first efforts at hybridization come

to fruition in July, 1977. A cross of "Ace" with "Dazzler" produced what seemed to be a more vibrant orange blossom. Currently I have many and varied crosses in various stages between seed and flower under the fluorescent lights in my basement.

My first departure from Ludwig breeding stock was use of a plant bearing the tag *Hippeastrum puniceum*. A cross of this flower with Ludwig's "Fire Dance" did produce seed. I recently obtained three species hybrids, all diploids, in the hope of producing forms of amaryllis that will be more suitable for light gardening.

At this point, let me explain some goals and thoughts that I would like to work toward. Maybe there are others who have similar goals, and some who have attained some of these goals. I would appreciate hearing of their accomplishments. The goals: (1) A shorter, sturdier growth without a loss in bloom size—features very desirable for light gardening. (2) A longer bloom period. (3) Increase in bloom periods. (4) Reduction in light requirements. (5) Discovering mutants. (6) Learning methods of inducing mutations.

There are some advantages to growing under lights. This statement may cause some raised eyebrows among our fortunate friends in the South who have outdoor growing conditions year round that bring beautiful blossoms every year at the same time. The advantages are: (1) Flowering can be more or less controlled at any time of the year. (2) The angle of light incidence can be controlled directionally. (3) The intensity and quality (i.e., wavelengths) of light can be varied within certain limits.

The advantages in point 1. are obvious, while that of point 2. is in the possibility of obtaining shorter, sturder growth. My efforts have not yet proven this, but I propose that use of light directed from the sides of the bulb, leaving a black area directly above the plant, will induce the plant to adopt a lower growth habit. Some plants would be more adaptable to this effect than others, and would be selected for further hybridizing. One observation that I have made is that light directed specifically to the side of the bulb and falling on the neck of the bulb has caused a far greater growth in this area of the plant. The result has been wider leaf growth and an expanded diameter of the scape in comparison to plants receiving light constantly from above only. The subsequent bloom was also larger. As to point 3, it offers routes to varying the length and frequency of flowering periods.

There is much food for thought and experimentation in Mr. Walrafen's report. Interested persons should contact him directly to exchange ideas and observations.

Another northern grower of *Amaryllis* is Melissa Romberger, 1440 S. 80th St., West Allis, WI 53214. She has experienced the unique joy of bringing a touchy, uncompromising species *Amaryllis* to flowering. Growing her plants under available-light conditions indoors and in unavoidable shade outdoors, she has managed to find an assortment of

species and hybrids which will still produce blossoms under these conditions reliably year after year. This sounds to me like the epitome of a successful horticulturist, since none of us is able to be all things to all types of plants at one time and place.

Mr. Isaac R. Hunter, Rt. 3, Box 33, Dowagiac, MI 49047, tells of growing numerous species and even more hybrids, many of his own breeding, in a well-lighted enclosed front porch. He had a nice bloom from his *Amaryllis papilio* in April, and *A. elegans* was in bud in late June. Mr. Hunter is interested in trying to keep a few species from the danger of extinction, but needs sources of pollen, if he is to obtain seed from his own plants. He finds that he gets better results growing species *Amaryllis* under his conditions if he uses a richer potting mixture than the one normally recommended for southern and greenhouse growers. Whatever he is doing sounds like it is the right thing at his location, and I am sure he would be happy to share details with others in similar circumstances.

In my own backyard, I finally saw the blossoms of *Hymenocallis azteciana*. After years of struggling with this touchy mexican spider lily, I was finally rewarded with the early August blooming of one plant in a large community pot. A late-summer sickness had thwarted this in years past, often leading to dead foliage and rotted bulbs. At the first sign of this in 1978, the pot was moved from full sun to partial shade, and watering was stopped. The signs of "summer sickness" quickly halted, and the bloom followed. A bulb of *Hymenocallis eucharidifolia* which had been nursed to large size decided to split into many smaller bulbs rather than bloom this year; apparently, there are limits to how far we can push these plants!

Crinum moorei flowered for me for the first time since I obtained it, as did a plant of *C.* "Thaddeus Howard". The blooming order for the season was x-*kirkii* and "Cecil Houdyshel" in June, then "Thaddeus Howard" in July, followed by "Ellen Bosanquet" in early August and *moorei* and "Burgundy" in mid August. All in all, a delightful Crinum year.

Habranthus concolor bloomed again, and set a good pod when self-pollinated by hand in the greenhouse. Numerous tiny *concolor* seedings are now thriving in 6-in. community pots. A large group of a pink commercial *Zephyranthes* clone was grown within a few yards of a long row of *Habranthus robustus* in the 1978 outdoor bed of tender bulbs. In the past, neither variety had ever been induced to set a pod but in 1978, both types yielded 2 plump pods each. I suspect the seeds are all insect-pollinated *Zephyranthes-Habranthus* hybrids. I intend to try growing a few of each.

The Northern Midwest Regional Report concludes with the following contribution from Jane Cullen. My sincere thanks to all the regional A.P.L.S. members who contributed to this report.

GROWING CRINUM IN NORTHERN ILLINOIS

Mrs. Edward V. Cullen
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Perhaps the only way to grow Crinums in northern Illinois, with its extremely variable climate, is through pot and tub culture. The Crinums I am writing about have been growing in this way for the past ten, most rewarding, years. The only drawback has been the necessity for large containers—twelve to eighteen inch diameters and even larger—are useful. Winter storage can become a problem.

At present, in growth is an assortment of twelve bulbs which include *Crinum moorei*, *C.* x-*powelli*, *C. bulbispermum*, *C.* "Cecil Houdyshel", *C.* "Louis Bosanquet", *C.* "Ellen Bosanquet", and *C. asiaticum*. The *C. asiaticum* is the only one that has not yet flowered. These have different blooming periods from May through September. All receive the same care simultaneously, and usually respond profusely.

In past years these bulbs were stored in their tubs, large pots, etc., under a greenhouse bench for the winter, where the temperature rarely falls below 50°F. It was inconvenient to reach the tubs for inspection, and at times the area seemed somewhat soggy for bulb storage. Last year, in an effort to overcome this, the tubs were stored in an adjacent, drier area with a temperature range of 55-65°F. Survival rate was 100% and bulb condition was very good. The higher storage temperature did not seem to be harmful.

Each year in April, as new growth is apparent, the containers are brought into stronger light and subsequently, to their outdoor positions. As they show activity, new top soil mixed with bone meal and dried cattle manure is applied as top soil. The bulbs are watered lightly at first, and then heavily as is acceptable. The bulbs are fed again in June, July, and finally in August, with a 3-16-6 formula or variations thereof.

Three times each summer and before storage, the entire plant is sprayed with a 57% Malathion preparation, at a rate of 1 tablespoon Malathion per half-gallon of water, as a preventative against mealy bugs. If other forms of life are visible, such as earthworms, sow bugs, or others, a soil drench would be indicated. To help eliminate these nuisances, it is advisable to prevent earth contact by placing the tubs and pots on two horizontal bricks, when they are placed out of doors for the summer, leaving drainage open at the bottom.

However much one dislikes disturbing the roots of the crinums, there are times when it is necessary to repot. At such times, consideration should be given to offshoots. If the offshoots are large and fast growing like those of *C. moorei*, it is feasible to remove them and plant them separately. When the large offshoot becomes independent and movable from side to side, it is likely to have a well developed root growth of its own. It can be extracted completely intact, as a separate bulb entity, with gentle back and forth movement. If the offshoots are copious in number but lacking in circumference, there is little to be gained from their removal. When many offshoots accumulate and appear to be competing for space, both above and below the surface, it is a personal belief that removal of a few or many is of benefit to the

source; and a happier picture is put forth.

Although pot culture of so many bulbs may seem an awkward way in which to grow crinums, there are few times as pleasant and rewarding as finding the first emergent bud of the season and watching its development into an umbel of flowers of the most equisite shades of pink, rose, wine, and others. Every bud thereafter is as much admired. Just now in full bloom are "Ellen Bosanquet", *moorei*, and x-*powelli*.

Each year, the question of whether or not to continue growing crinums in this manner is seriously pondered. As fall approaches, the tubs seem to find their way to their winter resting place; and each spring the cycle repeats itself. It has become a clean, quite predictable procedure, and a habit not easily discarded.

BLOOMING ZEPHYRANTHEAE SEEDLING WITHIN A YEAR OR LESS

DENNIS M. SPEED,

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My seed crop consisted of progeny of species, hybrids, and some of my own crosses among such Zephyrantheae as *Z. smalli, H. brachyandrus, Z. simpsonii*, Z. x 'Ruth Page', Z. x 'Betty Alvey', Z. x 'Mockingbird', *H. andersonii*, some un-named Mexican species, and others. These were planted about ten days after ripening as recommended by Dr. Walter S. Flory, of Wake Forest University. It has been Dr. Flory's observation that ripe *Zephyrantheae* seeds held in an envelope for about ten days after gathering take on some additional maturity. He has also observed that holding seeds more than ten days after gathering causes the seed to become less viable - especially after long periods of time.

Five gallon cans, and big three and four gallon capacity crock pots, were chosen to be seedbeds and the future "home" for the development of my seedlings. These were intended to "carry" the young plants into their first bloom and on into two or more years afterward.

"Home" locations were to be mobile and flexible for both Summer and Winter. Large soil mixture volume was chosen for several reasons. A constant supply of plant nutrients was wanted. The moisture supply was intended to be constantly available and with the least effort. Hand watering from the tap would be minimized as long as the plants remained in their imposed habitats. Rainwater as nature provided it would not remain in excessive amounts because good drainage was to be supplied and gravity would also be in action to take water downward in the pots and cans.

Root climate was intended to be so stable it would fluctuate only slightly between daytime and nighttime as well as from day to day. Large space was provided for root development. Larger containers than these would have been selected if they could have served without overtaxing human brawn and back limitations.

Large containers would incourage root and feeder-root development that would approximate that of outdoor in-the-ground culture where moisture, temperature, and plant nutrients are virtually unrestricted constants of a plant's universe.

Drainage was to be so efficient neither human error or Mother Nature's over indulgence would harm the plants at any growth stage. Big cans and pots promised near fulfillment of these requirements.

To support these grand ideals, the soil formula was to be as complete and efficient for young Zephyrantheae seedlings being cultivated into adulthood as that of a modern day formula for growing human babies into adulthood.

Present or prepared drain holes in the pots and cans received the usual pieces of broken crockery or stone over them. About two inches of river gravel and sand occupied the bottom of the cans and pots. The rest of the pot or can was filled to within two inches of the top rim of it with a mixture of native sands, humus, rich sandy graden loam and sphagnum peat moss. By volume peat moss made up close to 50% of the total soil mix.

Mixing was done in a metal wheelbarrow with a hoe. Tapwater was added to make a soupy mass similar to that of mortar for a stone-mason. The peat moss was dry and needed much water to soak it to near its' capacity for water storage.

Within about twelve hours after mixing and filling the containers, planting conditions were almost perfect for Zephyrantheae seed. Excess water had drained out and/or had been absorbed by the mixture of soils and peat moss. This excellent soil condition gave me a test for possible future behavior of my soil when it would become oversaturated with water. My soil prescription was very satisfactory.

Fingers and thumbs became tools for forming depressions in the medium. Individual seed were placed in the holes spaced about two inches apart. Seed were covered with about one-fourth inch of coarse native "blow sand" or coarse sand from a sandbar in a local steam.

Both sands are almost void of elements of cohesion. They were used simply to cover and to hold the light seed down until germination was completed and their roots had anchored the plants in the soil. Any other coarse sand or fine gravel could have served the purpose. If tap watering is done on new planted Zephyrantheae seed, they may float to the top of the water and lose their desided cover and positions. The sand covering helped prevent that occuring. It also provided easy upward penetration of the "pegs" of the monocotyledon's seed.

When planting was finished, a piece of transparent plastic sheeting was placed over each container following a dampening sprinkle of water on top of the sand. Plastic covers were secured with a piece of "hay wire" tied around the plastic at the top of each pot or can. This gave quick easy opening of the units to check germination and moisture content of the soil.

A near perfect germination climate was then present. High moisture and high humidity coupled with warmth of the sun-to-earth-to-pot-

to-air teamed with light to bring forth quick germination.

After planting was finished, the containers were placed where shade from a tree would be on them during mid-day hours. When germination was completed, the plastic covers were removed. As soon as soil in the pots dried some, a solution of water and Ra-Pid-Gro was used at the rate of one teaspoonful of Ra-Pid-Gro to a quart of water. A regular feeding and watering schedule was set up. Every other week the fertilizer-water solution was used. If more water was needed it was applied as necessary.

The two inches above the soil in the containers gave room for large quantities of water at a time. That eliminated frequent watering periods.

Containers were moved according to sunlight needs as the season progressed to cooler temperatures and lengthening shadows. Before frost time the containers were moved into my greenhouse made of corrugated clear fiberglass. Solar heat gave good growing temperatures part of the time during Winter. When cold spells came an LP gas stove kept temperatures just above the freezing point.

My fertilizing program continued throughout the Winter with additional fertilizer sprinkled on top of the soil in the containers. That fertilizer was the same as a farmer would use on his field crops (pelleted for slow release of plant nutrients). Analysis was 14% Nitrogen, 28% Phosphate, and 14% Potash. Growing never stopped until Spring when they were moved outside into near full sunlight all day. From that time, bulb growth and development was very rapid.

First bloom occurred at about 10 months after seed planting. Other blossoming followed until all but one pot of seedling had bloomed within one year from seed planting time. Some clones gave encore performances of bloom, others gave only one round of bloom. At the time of this writing, all clones have bloomed a number of times and many of them are crowding the pots with prolifera.

This is not the first time Zephyrantheae have flaunted their colors and perfumes to pollinating insects, the breezes, and man within such a short time from their genesis from seed. Dr. Thad Howard once bloomed hybrid Zephyrantheae in nine months by wintering seedlings in a greenhouse (PLANT LIFE 29, 1973, page 90).

In notes received from Mrs. Kathering L. Clint, she mentioned quick bloom on Zephyrantheae. "We frequently had seedlings bloom in the ground the following season. The seeds were germinated in flats and transferred to the ground as soon as the tiny bulbs had formed (8 to 10 weeks). The trick is to keep the seedlings growing at all times with food, water, and cold protection." She said, "Even species that normally need a rest period as mature bulbs should be kept in active growth the first year. "Your author agrees with Mrs. Clint's summation of the circumstances outlined for early Zephyrantheae bloom.

Previous experience with planting and blooming Amaryllis from seed gave the pattern to apply to Zephyrantheae early bloom. I would not hesitate to attempt this method for obtaining early bloom for many

other Amaryllids.

It isn't for me to say that my method is practical or even profitable. However, I believe many of you can create your own "Sesame Street" lined with quick Zephyrantheae bloom from seed if you use your native resources, imagination, and keep friendly relations with the "Good Gardening Genies" if you please!

GROWING AMARYLLIS AND OTHER PLANTS IN THE NORTH

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Dr. James E. Shields wrote that he thought that others might be interested in the growing of *Amaryllis* up north in a house without any special equipment such as a greenhouse. Although I belong in this class, I do use some lights.

For one thing, I do grow more plants than just *Amaryllis* or even Amaryllids as I've found that *interest flags when concentration is solely on a single genus* and all does not go as to plan or well. Therefore, there are AFRICAN VIOLETS which glow with color when many *Amaryllis* sulk. FERNS to give form and color, SEEMANNIAS crowd many pots. ZEPHYRANTHES beat the *Crocus* to bloom to announce Springtime. BEGONIAS bloom in the dullest of Wintertime's shortday times, and so-on. If the *Amaryllis* fail to do well, there's next year which sometimes may run into as many as 7 or 8 years before certain seedling pots spring into bloom. For there are many failures *up North* here because of our kind of weather, and that so much of the time, they must be grown indoors where the temperature and light conditions are not up to their inborn needs. For instance, I found that anything with *Amaryllis evansiae* most likely will not grow to "bloomsize" in the house; although, when the inside temperatures were much higher (now set at 62-65° F. while I'm away at work) *Amaryllis evansiae* grew well and bloomed for me, but now they slowly decline more and more until they just fade away. Anything with *Amaryllis aglaiae* in its make-up is even worse *except* for the cross of *Amaryllis papilio* x *Amaryllis aglaiae* of which enough seedlings partake of the *A. papilio* vigor and grow like weeds; even blooming precociously at times. Which brings to the fore, one of my favorite species, *Amaryllis papilio.* My three clones (and each is different) are directly from Dr. Carlos Gomez Ruppel and took a span of some years before his production by offsets could provide a bulb for me. It is my favorite *papilio.* Although it has never set selfed seeds for me, yet; it is a good brood-mother for crosses and is the clone which he calls "Brown" (mostly) evergreen as it does not lose its entire crop of leaves when it goes into partial dormancy during late Spring. The other two clones do lose all their leaves for several months but I'm surprised this year with a bud showing (now) while *papilio* "Big Seed"

is in its Sumertime (July) dormancy. This is a first! "Big Seed" when selfed produces huge seeds for a *papilio* when first shelled-out.

On the 27 February 1974, I received several seeds of an "*Amaryllis* cross" by Mr. Sterling S. Harshbarger of *Amaryllis papilio* x *Amaryllis reticulata* (which I've shortened to "Papillata"). This flower closely resembles that one illustrated in Dr. Traub's AMARYLLIS MANUAL, page 87, which he entitles *Orchard-flowering Amaryllis Hybrids (D-6)*. It's flower color is pure white with (frankly) magenta, but I find it highly pleasing. It will bloom at times with up to four bloom-spikes within several months and again several months later, then starts to bloom again. Five are the most blooms per spike but considering that *A. papilio* has but two, it does well. This cross carries the disease resistance of *Amaryllis papilio,* its vigor, its highly ornamental leafage with bold stripes down through the midleaf; and the genetic make-up for new color patterns with "blotch" inheritance, and greater breadth to leaf width. Its offspring are out of this world. It imparts a pleasing deep green color in its leaves, and vigor to its seedlings. I hope to run-through a number of species and choice hybrids with "Papillata" for I believe that many interesting quirks may lie within "Papillata's" genetic makeup. These "quirks" may be able to contribute further valuable traits to good, beautiful, and healthy *Amaryllis.*

I do not have blooms on *Amaryllis* in *every week* of the year but I do succeed rather well in having bloom *amongst the months* of the year. Sometimes, one just waits for a certain clone to bloom as in *Cothran's #339-yellow* for it has such a *lovely form* and a *unique color*, one wishes that it would just bloom and bloom again and again. One of my errors in judgment, in hybridizing this year, was in not using it's pollen on *Amaryllis traubii* (a good podparent for me) when it was in bloom this year. For I've seen pictures of Dr. Boutin's clone: *evansiae x traubii*, simply gorgeous, gorgeous (and some think better than *Amaryllis x henryae*) and what would not *Cothran's #339-yellow* have done?!

Further, there is always the collecting of the species that one has longed-for and awaited with such patience, and awaiting its surfacing, such as *Amaryllis belladonna haywardii*. However, *my faith* is so little that it's never allowed itself to hunger for *Amaryllis fragrantissima*, but it is a stimulant to *Amaryllis* growing that adds spice to it. Furthermore, there is the receiving of hybrid clones which others have worked on for years such as *Cothran's #339-yellow* which came my way out of a clear blue sky and I didn't even know what a jewel it was until after further correspondance. One should be willing also *to share with others*, one is sometimes surprised what is lacking in their collections.

As to culture, I differ from many warm-area growers in that I try to give the bulb as large a pot as is healthy for it with more than half of the pot filled with broken claypot sherds which are placed to allow a large root area which stimulates vigor. I give a normal amount of fertilizer in water, monthly with other additives which maybe needed for the soilmix. I do try to incorporate crushed eggshells into my potting mix consisting of commercial black potting soil, and peatmoss (the dry, dusty kind with roots, etc. in it).

GROWING AMARYLLIDS IN VIRGINIA

Mrs. Hart Forberg,

21 Albermarle Av., Richmond, Va. 23226

Bulbs have been my special interest since the spring of 1928, when they wintered over here without any extra care. In Minnesota where I grew up it took good mulching held safe, from the winter winds to keep bulbs. Following the usual spring burst of color in small bulbs, great joy can be had through the many types of hardy & tender Amaryllids, making a year round sequence of color, size & beauty.

The Crinums are well suited for the Virginia climate. They grow & multiply fast. A well grown bulb is often several pounds in weight and will do well where other bulbs fail. They are a blessing, with the lily-like blooms in pink, white and lavendar, some plain and some striped. It is necessary to use crow-bars to dig them, using two persons, each lifting from the side opposite the other. Clumps have reached 125 lbs. For this reason mine are not divided like they should be. The lavendar ones are from China and have a drooping position on the plant, (orentalis var.), rest are white *C. bulbispermum*, the milk & wine lily with the white petals striped with (red or maroon color). I did have the *C. americanum*, however it froze in the severe winter of 1977, the coldest ever here. I saw them growing wild in Texas near Houston and in the Florida Keys. They make wonderful flower designs with their graceful little wisps of white flowers.

The Alstroemerias, or Peruvian Lilies, are among my favorites. Since the rootstock is not a leaf encased bulb, but rhizomatous, one must give them winter storage care. The stalk is so heavy as well as the leaves with food & water, that I leave them in the ground until *eight* days *after* the first hard *frost*. This permits the food to travel back to the rhizomes before the tops are dried off. They are packed in sand and peat moss to preserve the roots which remain fleshy and are a permanent part of the plant itself. Storage as with the *Amaryllis* should be in the 50°F., bracket. Planting in spring when the rhizomes are separated, should be on the 1st. day of June, (in Va.)

When the *Alstromeria, Amaryllis* (syn.-*Hippeastrum*) or any others are stored at less than 50 degrees the flower bud often disintegrates and as a consequence, *no bloom*. This is the most common error, storing it either too hot or too cold. By the 1st of June the ground is warm and you can expect blooms in 14 days if there is the usual moisture. Are quick growers and they fill a gap in color when it is needed. They are a good investment as they multiply fast, however when the bulbs are old, 20 years or so, they bloom but cease to have offsets. If you wish to produce bulbs faster you may cut up a large bulb into pie shaped sections before planting. Retain a part of the plate with each cutting. Have the place to plant prepared ahead and cover the sections with a layer of mud, then plant immediately. I have tried this and it works. (See Traub, Propagation of Amaryllids by stem cuttage. Herbertia 2:

123-126. 1935.) The first time cutting 19 sections from 1 bulb and planting: 18 bulbs in top shape were produced, only one failure. Takes 2 years for these to bloom.

Zephyrathes, are good garden standbys here as shown after a freshet of rain. They seem to be disease free and multiply well.

Sternbergia lutea is a fall blooming species and has often graced our table for Thanksgiving Day.

At this writing Oct. 31, the *Amaryllis* are all stored inside the house in pots, on the side, that the air may penetrate the soil. I move them one fourth of their circumference each time I water which is seldom. Rarely ever one fails to bloom. They are never repotted unless they break their enclosure, it is their signal they need more space. Of course the roots remain in the same position of growth for their life cycle. Most people either over crowd the pot or use one too large. Only one inch should be allowed around a bulb, between it and the pot and nearly one half of the bulb above ground. The rain water is used generally to moisten them.

Miniature Amaryllids. Two years ago a society member sent me an envelope of *small* miniature bulbs. Some have bloomed while others just multiplied. These are a joy & a delight to all. They are so small you can put several in one pot and still get blooms. The foliage is 6 to 7 inches so they take less room. The bloom is large on a 7″ or so. stem. I am so happy with them and am wondering if anyone can help me, locate a source of them. They are not listed in any catalogue here. If anyone knows where they may be secured please advise. The following are what I tried & some bloomed. *A. equestrex-evansia*, a "reblooming" pink. *A. striata, A. starkii, A. flamigera, A. 'Zenith'*, a large red-orange *striata-argilagea*— Not all have bloomed yet but all did produce offsets.

Here are two incidents involving Amaryllids: My son an officer in the Navy when in Leyte received orders to return to the States. He had to walk on foot several miles to where a plane would pick him up, gear and all! It was hot & humid and he felt he wouldn't make it on time when all of a sudden in his view were many Crinum. They were exactly like the ones in the back yard here at home and gave him a stimulus to carry on, & *on time!*

During the war years when Asst. Dir. of the Virginia Nature Camp of the Va. Fed. of Garden Clubs, I made field trips into the George Washington Forest from Lake Sherando, where the camp was then situated. On two trips I found great mounds of Hypoxsis-Hysurta, an Amaryllid, called yellow star grass. This was a sight, with the tiny star shaped *blue* flowers and the *sword like* grassy leaves. I had read they grow wild from Maine to Fla. but have only seen them there and on Mad Mountain in Richmond where they were grown on a creek-side and by Nature. It is wonderful to recognize even one of God's creations not trifled by man.

AMARYLLIS EVANSIAE

Douglas D. Craft,

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(Mr. Craft served as Artist for the Society from 1959 to 1962, inclusive. The reader is directed to the PLANT LIFE issues of that period for samples of cover designs contributed by him.—*Editor*)

In the spring of 1977, the author ordered a bulb of *Amaryllis evansiae* from Geo. W. Park Seed Company. The bulb came already growing in the company's soil mixture in a 2″ fibreglass pot. From what could be observed the bulb appeared to be about the size of a large acorn. It shortly put forth a bud and one tiny offset. It eventually bloomed having two separate scapes with two flowers, slightly upturned, per scape . . . it wasn't "creamy white" as the catalogue described but more an ivory white with a light chartreuse-greenish throat . . . lovely all the same. When scapes died back, it was repotted to a 7″ pot, using a mixture of soil formulaes recommended by L. Doran and others, fed alternate weeks over the summer with Atlas fish emulsion and Hyponex and monthly drenches of Benomyl 50% W.P. (Benlate) at the rate of 2 teaspoons per gallon (see Doran, Plant Life 1976, p. 39). The writer was rewarded with five offsets to date. It is hoped to fill the pot with this species and bulbs should be available to Society members, interested, when they crowd the pot or seem to need repotting.

The parent bulb seems to have increased to double its original size at this writing . . . the end of January 1978. It has been resting completely dry since the beginning of November. According to Doran, this species seems to need about a three month rest of complete dormancy . . . the leaves drying back. It is this writer's observation that this species seems to bloom without leaves as in contrast to *A. striata* which seems to be completely evergreen the year around, although the latter is not watered as much during the winter months. This author's small collection of species either grows or goes into dormancy in a small plant room (similar to a cool sunroom) with good south exposure for the winter sun. Temperatures range from 45° to 50°, nights to around 80° daytime . . . less of course on cloudy days. Most plants are moved outside to the porch with southern exposure, partially shaded by a peach tree, for the summer months and where the summer rains can both nourish the soil as well as wash out any extra salts from fertilizers, etc. Feeding is completely withheld for the winter months. Sometime in February, the author will begin to water *A. evansiae* very judiciously and sparingly until bloom begins and then more and more frequently as growth progresses until almost continuous daily watering is given over the summer.

This writer's potting soil mixture for this species is: 2 parts leaf mold, dirt from a woods nearby; 2 parts Vermiculite; 2 parts coarse and fine sand; 1 part 2 or 3 year old cow manure from a farm; ⅓ part

Fig. 24. **Amaryllis evansiae.** Drawing by Douglas D. Craft.

steamed bone meal; 1 part charcoal.

To this is added ½ teaspoon superphosphate and ½ teaspoon lime per 6″ pot. The 7″ pot was filled to half full with coarse sand before above soil mixture was added. All soil is sterilized also by baking in oven at 180 to 195 F. for no longer than an hour and a half.

The author wishes to state his gratitude to L. Doran for his gracious and generous suggestions on growing the species . . . by correspondence as well as earlier articles in PLANT LIFE.

At some future date providing the writer is still successful, a report can be made on the growing of some small species crosses from seed supplied so generously by Dr. W. D. Bell; as well as seed of *A. aglaiae* and *A. starkii* kindly sent to the author by L. Doran.

EUCHARIS LILY - COLOMBIAN COUSIN GROWN IN CALIFORNIA

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This genus of the Amaryllidaceae from northwestern South America and adjacent Central America seems to be a neglected group. The Eucharis Lily or Amazon Lily, *Urceolina grandiflora* (Planch et Linden) Traub (See reference, Traub, 1971 at end of this article) is offered commercially and is sometimes included in books on house plants; but the emphasis is often on its being a greenhouse plant and the descriptions, cultural advice and estimates of tolerances are at variance. It has been under cultivation for a century and a quarter, the most widely grown species and once a very popular florists' plant.

All of the twenty-one species are evergreen, all are fragrant, most are smaller than *U. grandiflora* and at least two have partly yellow-petalled flowers. Most are native to mid-Andean altitudes in deciduous forest. One much larger species was found at a lower altitude in the far south of the range (1,000 feet, northern Peru). In general, the habitat provides generous air and ground moisture, wind protection, shade, good drainage, frost-free moderate temperatures.

For greenhouse growing, it might be better to go to a British source, but the *U. grandiflora* bulbs being discussed here were imported from a commercial nursery in India (at a guess, a West Bengal hill station). From long-cultivated and presumably selected stock, they are considered suitable for growing and flowering outdoors in the warmest parts of the United States. The family has more spectacular flowers, but how many are broad-leaved evergreen shade plants of good size and proportions that require no major work for three years at a time? Then too, it has possibilities—there have been hybrids produced between two species and between *Urceolina* species. The following combines a description in lay terms and a record of twenty months' growth outdoors in Zone 10 of six *U. grandiflora* plants that so far have merited

their name (pleasant, agreeable) in more ways than the scent of th flowers to which it refers, while the first flowers have been larger tha promised by the seller.

The plant grows an arcing fountain of broadly elliptical leaves deep rich green and glossy. A solid stalk, somewhat triangular in cross-section, continues as midrib of the leaf, depressed on top and protruding underneath, decreasing in girth as it approaches the modified drip-tip. Acutely angled channels pattern the leaf, in close-set, curving, parallel lines. Mature leaves are about 10 inches long by 5

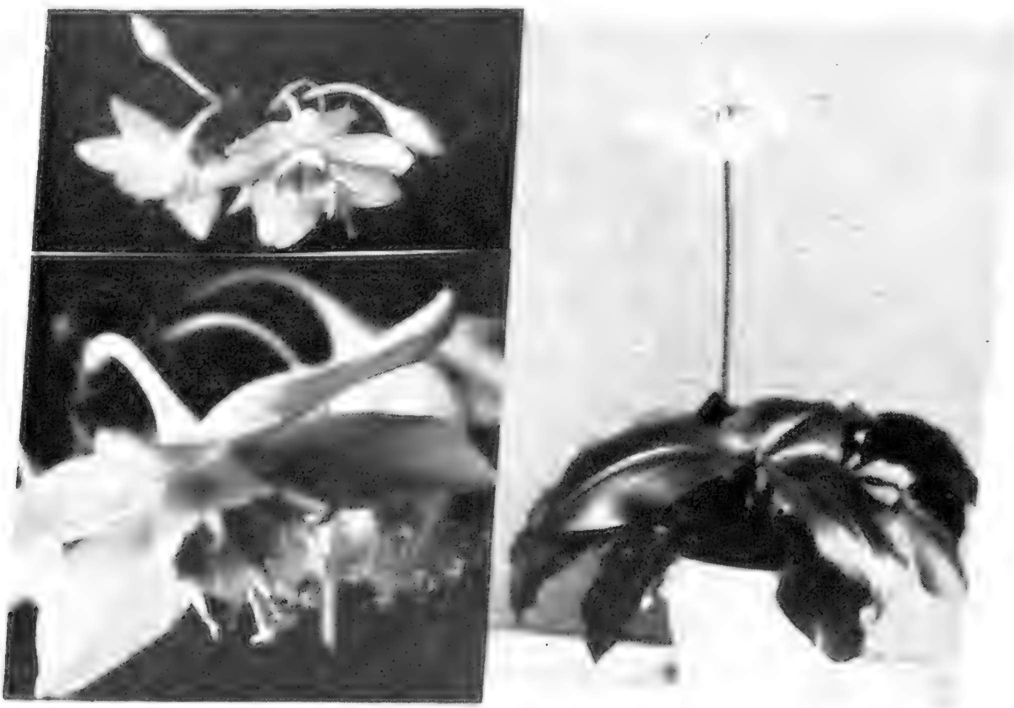

Fig. 25. The Eucharis Lily, **Urceolina grandiflora** (Planch. et Linden) Traub as grown by Jane E. Lewis, San Diego, California.

inches wide on 4 to 5 inch stalks (a few exceptions noted in the record). The new leaf is a curious sight, appearing as a tightly furled upside-down scroll. When about 3 inches long, it begins to unroll from each side as its stalk clears the surface; when fully open it continues to grow, darken and develop markings while the stalk lengthens. The leaves are quite substantial, show a faint translucence when backlighted and are attractive in motion as they tilt from side to side and ripple slightly. The "fountain" is held high or low, changing with varying moisture and temperature.

Under optimum conditions, *U. grandiflora* can be brought into bloom three times a year. Twice might be more realistic an estimate for outdoor growing, but even once a year would be acceptable for such a handsome flower. The solid, oval scape rises to a maximum 24 inches and terminates in an umbel of gracefully pendant flowers said to increase in size and number with plant maturity. Information varies: 2 to 8 or 10 flowers; 2, 3 or 4 inches in diameter. Here, first blooms were 5 to an umbel, 3½ inches across. The individual blossom has been described widely as resembling a narcissus, an over-simplified understatement. There are six substantial waxy-white petals, broad, pointed and alternately overlapping, on a slim tube. They open flat-out, show a ridged pattern down the centers. A scalloped bowl-shaped cup is tinged pale green inside and out; six darker straitions end in a surrealistic touch - dangling elongations that quickly develop into visable stamens and anthers. The green tinge turns to a cool yellow as the flower ages. The style protrudes slightly beyond the anthers, ends in a 3-lobed stigma. According to the literature, the flowers are highly, delightfully, deliciously fragrant, but almost no one has attempted to describe the scent. One British source says it is classified as a lily scent, leaving plenty of room for individual opinions. A great many in bloom at one time in an enclosed place may impart much fragrance, and even smell different. Otherwise, one needs to be close to catch it and it seems like a light, fruity fragrance. A first impression was of freshly cut grapefruit with a dash of tangerine and minus the tang of bitter rind. It was strongest on the evening of the first day of each flower's opening. In their native habitat, they are pollinated by night-flying moths. These six produced no seed. There were many ovules in the 3-part chambers at the base of the tube. The flowers are urn shaped and dry to a beige papery state, rustling in a breeze without losing their grip, while the stalk stands sturdily even after it is flat and dry.

MARCH 1977—Bulbs ordered in January received March 1. Globular, 1¼ to 1½ inches in diameter, dark brown, dry, almost weightless, no roots, many loose papery scales. Left overnight in deep pan of damp milled sphagnum, bulbs took in some moisture, looked plumper, felt more substantial. Removed loose scales. Three bulbs already sprouted when received, looked damaged. Planted with tops just below surface in Supersoil® (said to include Canadian sphagnum, firbark, redwood, vermiculite, sand and "selected nutrients" in unspecified quantities). Used styrofoam pots - light-weight, moisture-holding; "breathe" but do not collect salts and algae; have three extra drainage holes with channels to pot edges. The sprouted bulbs, which on leafing out again became Nos. 1, 2 and 3, were put individually into 5-inch standard pots; the other three, Nos. 4, 5, 6 in order of sprouting, were planted in a triangle equidistant from each other and the rim, in an 8-inch short pot (6 inches deep). About an inch of clay shards in each pot. Bulbs potted firm, watered from bottom, kept indoors in shade.

APRIL—Watered causiously around the bulbs and alternately from the bottom, keeping evenly moist. Water needed about every ten days.

After the first four weeks, Nos. 1, 2, 3 and 4 were growing new leaves. No. 1 lost the unopened damaged leaf, but Nos. 2 and 3 continued to grow their first sprouts, though twisted and scarred.

MAY—Soil settled a little, but bulbs did not protrude. Leveled surfaces, topped all with a little of same mix plus minimal amount of fish fertilizer (10-5-5, crushed tablets) with first watering in May. Switched to liquid 10-15-10 at half strength with third watering. Small pots began to need water sooner than large pot. Measured at end of month: Nos. 1, 2 and 3 - new leaves 6, 4 and 3 inches; Nos. 4, 5, 6 - new leaves 8, 6 and 5 inches. Only this once did the latter three grow faster than the former. Leaves long and narrow, stalks equally long, color a medium olive, linear ridges instead of angled channels. Measured light, found it to be less than 100 foot-candles at best on bright day. Put all outside in open shade on slatted redwood benches.

JUNE—Nos. 1, 2 and 3 had rusty streaks after two weeks outdoors. This started at mid-rib, spread lengthwise, then broadened an inch. Sunburn? These leaves faced west and direct sun from about 4 P.M. Placed large tubbed camellia west of *Urceolina* group. Each grew a second new leaf in June, in numerical order. These and subsequent leaves were broad with shorter stalk, channeled, darker without olive cast, of heavier substance, held at higher angle. Misted plants daily as days and nights grew warmer and humidity lower. Fed 10-15-10 every other watering, increased to full strength.

JULY—All grew and matured third leaves in same sequence and a few days apart. Rusty patches did not spread any farther and no more appeared. Fish fertilizer at full strength (10-5-5) as alternate, for trace elements. Misted daily and raised humidity by wetting down floor, redwood planters. Aided by well-watered and misted shade plants in immediate vicinity.

AUGUST—At beginning of month, Nos. 1, 2 and 3 started their fourth leaves while the others completed growth of third leaves, and at mid-month followered along with the fourth set. Same summer care.

SEPTEMBER—Nos. 1, 2 and 3 matured fourth leaves and No. 1 started a fifth. At mid-month Nos. 4, 5, 6 grew fourth leaves to full size. Summer routine as before.

OCTOBER—With No. 1 well in the lead, all put out their fifth leaves at a slower rate and lengthening intervals. Cautiously reduced water and fertilizer. Removed original a typical leaves as all were pale, dry, drooping.

NOV 1977 - JAN 1978—The last leaves all matured by mid-month and no new ones sprouted. Watering cut down, feeding stopped. Unusually rainy winter, more humidity, higher minimum night temperatures. Plants taken indoors briefly during a hailstorm and on a few nights when air dry, wind blowing and/or temperature in low 40's.

FEBRUARY—Second brief hailstorm damaged a few leaves, punching small holes or freeze-marking. Discovered there has been growth going on out of sight: soil level rose in small pots, reducing

headway from an inch to $\frac{1}{3}$ inch. Leaf growth started at end of month, so began feeding - fish first, as before. Planting mix in good condition, not packed down and draining well.

MARCH—Soil level now noticeably higher in 8-inch pot, leaving about $\frac{3}{4}$-inch headway. Each had a new leaf in numerical order, a few days apart and growing fast. Resumed step-up watering and feeding same as last year. Old leaves in excellent condition except for the few marks of hail damage.

APRIL—Another round of leaves cleared surface and grew to full size. Remarkably, no insect damage, although nearby plants periodically catch something from patio miscellany in background. Besides regular misting, plants have been sponged off now and then, using tepid faucet water with a few drops of Basic-H to the gallon. Plain tap water has been used all along for watering; this, of course, has been more rain and less Colorado River after last winter.

MAY—Another new leaf each at about same speed. Watered, fertilized and misted as usual. 10-15-10 up to full strength, now and throughout growing season, with alternate waterings. No direct sun allowed.

JUNE—Leaf growth still programmed. Summer routine same as last year. Mid-summer fish fertilizer, crushed 10-5-5 tablet per plant with last watering in June.

JULY—Nos. 1, 2 and 3 went to a new home in a shady, bricked-in bottomless planter, so no longer pot-bound; otherwise, environment and care much the same. As it turned out, the transplanted three and the 8-inch pot trio continued to grow the same.

AUGUST—Growth slowed, several mature leaves drooped and paled and the newest leaves remained half size and nearly stemless. Nervous speculation was followed by enlightenment (perhaps): news came that No. 1, still leading the pack, was pushing up a flower stalk; then they broke ranks and No. 4 followed. No. 1 scape was 5 inches tall when first seen on August 12 (in was hidden behind a leaf). No. 4 appeared on August 25; on the following day the inch-long flower head had cleared the surface. It was enclosed by 3 pale green bracts that were slightly open at the tips. The scape then grew an inch a day for six days. Being portable, No. 4 was easier to inspect closely and constantly, so is followed here; but No. 1 was almost identical in all respects.

SEPTEMBER—At 6 inches on the first of the month, No. 4 scape cleared its leaf umbrella. In four days, the bracts opened enough to show green buds. One at a time, each grew longer, whitened, turned out and downward on a long, slim tube. At sixteen days, the scape reached its final height of 18 inches. Two days later, the largest bud bulged in the morning, began to open in late afternoon and was fully open in 24 hours. The remaining buds ballooned and opened in about 6 hours, every second day. During the last week of the month, very hot, dry weather probably affected the lasting quality: the first flower began to shrink at 8 days; the fifth lasted only 5 days. During the blooming period, leaves growing closest to the scape began to stand

almost vertical and their stems grew longer. The most recently grown dwarf leaves remained small.

OCTOBER New leaves on all, growing slowly. On the 14th, No. 5 showed a flower scape. At the end of the month, it had reached 18 inches, but buds not as advanced as were those of No. 4 after 17 days during warmer weather. No. 2 flowered this month also. Size, height, number of flowers same as first two plants. Into the middle of November, with much lower temperatures, the flowers lasted longer, and faced outward rather than facing down. If they survive our ministrations and a second winter outdoors, these Bengali-Colombianos may yet become Californios.

LITERATURE CITED

Traub, Hamilton. *Urceolina grandflora* (Planch et Linden) Traub: syn. *Eucharis grandiflora* Planch. et Linden, Flore des Terres I. ix. 255. pl. 957. 1853-54; PLANT LIFE 1971, p. 58.

AMARYLLID MARKETING NEWS

(Under this heading, the names and addresses of those who have Amaryllids for sale, retail or wholesale, and brief notes on items for sale, will be listed *when information is sent to the Editor.*)

Marcia's Amaryllidaceae, Properietor, Mrs. Marcia C. Wilson, 255 Galveston Road, Brownsville, Texas 78521. Phone 512—541-2142. September 1978 catalog. Cultural notes, *Amaryllis* species and hybrids. Mini-tensiometer.

Sudbury Laboratory, Sudbury, Mass. 01776. Royal Dutch Hybrid *Amaryllis,* and soil testing equipment.

William D. Bell, (wholesale trade dealer), P.O. Box 12575, Gainesville, Fla. 32604, offers tetraploid *Amaryllis* stock for Amaryllis breeders, including all classes described in Traub's *Amaryllis Manual*, but it may be several years before most are available in any quantity. (See article in this issue of PLANT LIFE.)

Randell K. Bennett, P.O. Box 304, Sierra Madre, Calif. 91024: has a limited quantity of *Clivia gardenii* for sale, and will have *Clivia caulescens, C. nobliis, C. miniata* and *C. cyrtanthiflora* for sale, and possibly other amaryllids, in the future.

PLANT LIFE LIBRARY—continued from page 86.

IDEAS FOR SMALL-SPACE GARDENS. Pp. 80. $2.95. Includes sections on Small Can be Beautiful; Landscaping Guidelines; Basic Gardening for small spaces; Entry Garden; Long, Narrow side yards; Outdoor Rooms; Picture Gardens; City Gardens; and Spaces Shared with a Neighbor.

CACTUS AND OTHER SUCCULENTS. Pp. 80. $2.95. Includes sections on Cactus and Other Succulents; Cactus Collection; Favorite Succulents; Where Will they Grow?, and Tips for Easy Care.

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SOUTHERN CALIFORNIANS ENJOY BRIGHT FUTURE IN HEMEROCALLIS

SANFORD ROBERTS, *15011 Oak Creek Road, El Cajon, CA 92021*

Hemerocallis fanciers in California enjoyed increased activities in daylilies in 1977 and 1978. The Southwest Hemerocallis Society staged its first accredited show in July 1977 in San Diego's Balboa Park. This show was well received by the public and, in addition to providing a perfect staging of 218 horticlutural exhibits of cut scapes and individual blooms, provided arrangers an opportunity to create 38 artistic displays using the modern daylily in arrangements. Much publicity for daylilies was achieved by educational displays of hybridizing from the dried seed to a mature, blooming plant. A two-hour lecture, with 100 excellent how-to-do-it slides, was presented in another room of the park's Casa del Prado on growing hemerocallis in home gardens and their near-perfect use in landscaping. This was well attended by nurseymen, flower judges (garden and horticultural) and fanciers. Club members chose "A New Dawn," as the theme of this first accredited show. It is interesting to note that of the 218 horticultural exhibits, more than 95% were tetraploids. 'Chicago Star' (Marsh), a golden yellow, was selected as Best Introduced Cultivar by the three officiating American Hemerocallis Society judges. 'Jock Randall' (Peck), a warm red, won the Regional Popularity Poll Section. 'Mary Todd' (Fay), a universally acclaimed bright yellow, was tied as the regional favorite for 1977, as voted by Region 7 (Arizona, California and Nevada) daylily growers and AHS members. It was a particularly good year for the modern daylily.

In June 1978, the Southern California Hemerocallis and Amaryllis Society staged its first accredited show Hemerocallis at the Los Angeles City and County Arboretum in Arcadia. This was a two-day event, again with artistic arrangements, and it was well attended. Walter Gorrell, a member of both societies, was awarded a special rosette for his crowd-pleasing educational exhibit.

A week later, some members of both societies made the trek to Stockton and the regional meeting at Melrose Gardens.

In July, Southwest Hemerocallis Society members staged their second accredited show in San Diego. The show's theme, "A Day in the Tropics," had been selected in conjunction with the International Palm Society, whose members were concluding their biannual meeting with a farewell brunch in Balboa Park as the hemerocallis show was opened to the public nearby.

A theme staging of specimen *Cycas revoluta* (Sago Palm) from Mexico; *banksias* from Australia; the exotic proteas from Africa and *Haemanthus katherinae*, again from Africa—all of which were grown and owned by club members—set the mood for the show's theme. Additionally, members wore aloha shirts or colorful muus muus to complete the tropical theme for the daylilies. More than a thousand visitors

viewed and enjoyed the five-hour show. 'Watatic' (Himottu), a well-branched, many-budded, black-red cultivar, hybridized in Massachusetts, was adjudged as Best Horticultural Scape in the show.

A week later, several Californians attended the National Hemerocallis Convention in Pittsburgh. All reports from those attending reflected perfect weather, good bloom, and many well designed and landscaped gardens filled with most of the latest diploid and tetraploid creations from hybridizers.

The modern daylily is enjoying steady acceptance by California gardeners. The state's many micro-climates permit a long growing season and recurrent blooming tendencies in a cultivar is perhaps the most desired trait in a new introduction. Landscape architects continue to use the ubiquitous orange-yellow cultivar profusely in landscaping freeways, public buildings, banks and restaurants. The modern daylily, both diploid and tetraploid, is probably a long way off in being used as mass landscape material in the western states, probably due to lack of wholesale outlets for the modern daylilies.

The fancier and home gardener can, on the otherhand, select a wide color range of excellent cultivars in diploid and tetraploid plants to grow and enjoy through most of the year. Some recent introductions flower from February through November and offer much enjoyment in the garden. Among recently introduced cultivars, these have been observed for two years, and are considered some of the best obtainable: 'Apple Tart' (Hughes), ruffled, dark red with green throat; 'Barbarossa' (Peck), a wide, overlapping cherry red self with green throat; 'Botticelli' (Munson), large, deep pink self; 'By Myself' (Peck), light gold self; 'Chicago Firecracker' (Marsh), full Chinese red self with chartreuse throat, recurring bloom sometimes double; 'Chicago Star' (Marsh), golden yellow self; 'Chinese Autumn' (Munson), brilliant blend of coral, orange, rose, gold and apricot, all pleated and ruffled; 'Christmas Wreath' (Drake), round, flat, deep red self; 'Coral Gem' (Roberts), coral self with orange throat; 'Dawn Ballet' (Reckamp), perfection in a peach-pink blend; 'Evening Bell' (Peck), large, pure golden yellow; 'Gaugin' (Munson), sunset blend of coral, tangerine and rose; 'Gentle Dragon' (Peck), pure red, often double in recurring bloom; 'Ginger Creek' (Blocher), a ginger blend with extra petaloids for breeding doubles (This cultivar and Reckamp's 'Dawn Ballet,' similar in size, excel in near perfection.); 'Inca Torch' (Reckamp), golden orange of heavy texture; 'Iron Gate Geisha' (Sellers), rose pink, recurved self; 'Lusty Leland' (Peck), fiery red self of excellent fertility; 'Mary Moldovan' (Moldovan), superb quality in peach-pink blend; 'Mary Todd' (Fay), medium yellow self and a top performer; 'Meadow Mystic' (Wiese), excellent lavender with green throat; 'Olive Bailey Langdon' (Munson), deep violet purple self of frequent rebloom quality; 'Quinn Buck' (Peck), ruffled, bluish lavender, still scarce and named for a fine amaryllis and hemerocallis hybridizer from Southern California; 'Round Table' (Peck), a strawberry veined pink with much ruffling; 'Ruffled Apricot' (Baker), a large and showy apricot self;

'Sacred Shield' (Reckamp), a fine, heavy textured apricot-melon; 'Scarlock' (Peck), a recurved bright red; 'Sombrero Way' (Reckamp), a flat-formed, deep orange-pink; 'Tammas' (Peck), a fine raspberry purple with green throat, probably best in partial shade; 'Viracocha' (Roberts), a mammoth, deep orange of great carrying power for the show bench and garden; and, 'Watatic' (Himottu), a well-branched red.

One of the most popular tetraploids seen in many gardens is 'California Butterfly' (Traub), a big, bold and brassy yellow offering much enjoyment in a golden shade of yellow.

The foregoing are some of the best of hybridizing efforts to-date, in tetraploids. The future is indeed bright for hemerocallis in Southern California. The hues and colors are becoming highly refined in breeders' work and soon the good white and possibly a blue may also be available to further enhance the color spectrum.

SABAL TEXANA: A SANCTUARY WITH A HISTORY

Mrs. Marcia C. Wilson,

255 Galveston Road, Brownsville, Texas 78521

There is much interest today in preserving antiquities of nature and man, whether it is a relic from the sea, a delightful example of architectural style, or an endangered plant species on a romote desert plateau. About seven miles east of Brownsville, Texas, we have our own antiquity which probably has not made the news in your area. It is the *Texas Sabal Palm Sanctuary of the National Audubon Society*, ceded to them by oilman *Ben F. Vaughn* with financial assistance of the *Exxon Company* in 1971.

In 1519, Spanish explorer *Alonzo Alvarez de Pineda* was sent by *Francisco Garay*, governor of Jamaica, to find a water passage to the Orient. Rebuffed at Veracruz by Cortez, Pineda sailed north with his four ships and landed at the mouth of the *Rio Grande River*. Here they camped for a month to repair their vessels and trade with the Indians. Exploring twenty miles up the river in a small boat, Pineda described a vast palm forest in his report and named the river *Rio de las Palmas*. In 1974, a group of Naval Reservists, camped near the mouth of the *Rio Grande*, uncovered the decayed remains of an ancient wooden boat with wooden pegs and a broken slab about 12″ x 2½″. Translated, the abbreviated inscription reads: *Here Alonzo Alvarez de Pineda, Captain 1519, with 270 men and four ships, of Garey. Colony of Garay.* Attempts have been made to authenticate the relic. (Ferguson, Henry N. 1976. *The Port of Brownsville.* Springman-King Press, Brownsville, Texas. pp. 11-14.)

The *Texas Sabal Palm Sanctuary* is a small remnant of the large forest reported by Pineda and represents the only truly indigenous species of palm in Texas. In 1890, about 20 years before my paternal grandfather moved his family to Brownsville, Frank Rabb bought about 3000 acres along the river and built a grand two story home. Locally,

the property is still known by either Palm Grove or the Rabb Ranch and has been visited through the years by four generations of my family.

Our Editor, Dr. Traub, is quite interested in history, and asked that I revisit the Sanctuary. I invited my brother, Morris Clint, Jr. and his family. Morris is quick at recognizing native plants in our area and his son Chip (Morris W. Clint III, aged 13) is good with a camera.

The Rabb home is still privately owned by Mr. Vaughn, who is about the fourth owner. It is well maintained and impressive in this remote setting. To the left of the home is the cottage of Audubon Warden *Ernie Ortiz*, a friendly warm natured young man with experience

Fig. 26. The Texas Sabal Palm Sanctuary, Rabb Ranch House. Photo by Morris W. Clint III, aged 13.

as a plantsman. In bloom in his garden was a row of *Crinum* 'Ellen Bosanquet', a lovely old and popular dark pink hybrid. Warden Ortiz told us that *the Audubon Society had fenced about 40 acres of palms for the plant and wildlife Sanctuary.* He had worked for a wholesale nursery on the property at the time of *Hurricane Beulah.* This hurricane hit Brownsville September 19, 1967 with winds up to 140 miles an hour and destroyed the nursery. Remnants of other palms and some propagating stock can be seen naturilized along the well cleared walking trails. We were also told that the palms had not set seed in the ten

years or so since *Beulah*. On the day of our visit, June 18, many of the palms were loaded with creamy or greenish white inflorescences and it is hoped that rains will come at the proper time for seed setting this year. There is not a large proportion of seedlings or young palms in the grove. Accidental fires and high winds keep the tall palm trunks fairly clean of old leaves. One unrooted *Sabal* was flat on the ground and still growing.

Fig. 27. The Texas Sabal Palm Sanctuary. **Left**, Inside Sabal forest. Tallest palms, 25-30 feet; trunks cleaned by fire. They normally keep their leaf bases, which probably helps to make them hardy. **Right**, Edge of Sabal Palm Forest, showing old leaf bases; some palms have fuller "skirts", protected by wind from fire. Photos by Morris W. Clint III, aged 13 years.

Well sprayed with mosquito repellent (which had to be replenished before the end), we made a circular tour in a little over an hour. In the shaded interior of the Sanctuary, the *Texas Ebony* tree is fairly common, although the *Sabal* predominates. Since the *Sabal* is a fairly rapid grower in this area, I imagine that density varies with growing conditions through the decades. Walking along the outer perimeter during our short visit, we saw the following woody plants growing with the palms: *Retama, Tenaza, Mesquite, Anaqua, Palo Blanco, Mexican Persimmon, Cassio (Youpon), Granjeno, Huisache, Catsclaw, Brazil, Tepeguaje, Guayacan, Guajillo, Colima, Snowberry, Dewberry* and *Wild Turk's Cap. Carizo* (Giant or Water Cane) and *Sand Bar Willow* grow toward an old resaca bed. All of these interesting vernacular names are used currently and may be found in the general index of Robert A. Vines' *Trees, Shrubs and Woody Vines of the Southwest*, University of Texas Press, Austin. 1960.

GARAVENTA'S "GENUS ALSTROEMERIA IN CHILE"

HAMILTON P. TRAUB

Through the kindness of Dr. C. G. Ruppel of Argentina, Mr. Floor Barnhoorn in South Africa, received a reprint of Augustin H. Garaventa's "Genus *Alstroemeria* in Chile" which was publiched in Anal. Museo Hist. Nat. Valparaiso. 63 pp. in 1971. Mr. Barnhoorn had the article translated into English and kindly sent a copy to us.

The objective of the present article is to furnish a key to the 19 species, one variety and two forms, of *Alstroemeria* in Chile, for *Alstroemeria* enthusiasts in the United States.

KEY TO THE **ALSTROEMERIA** SPECIES OF CHILE ACCORDING TO AUGUSTIN H. GARAVENTA

1a. Plants normally higher than 30 cm.; leaves resupinated, ciliated:
  2a. Leaves ciliated:
    3b. Flowers reddish-yellow. Aconcagua and Malleco ....1. **haemantha** R. & P.
    3b. Flowers not yellow:
      4a. Flowers intense purple-violet. Prov. Coquimbo ....2. **sierrae** C. Munoz P.
      4b. Flowers very pale violet-lilac; Province Coquimbo ....3 **gayana** R. A. Phil.
  2b. Leaves not ciliated:
      5a. Flowers with mucro, rose, violet or whitish:
        6a. Leaves grass-like:
          7a. Flowers intense rose color; 12-18 mm. long. Coastal mountains and Andes of central Chile to Prov. Coquimbo and south to Cautin .....4. **revoluta** R. & P.
          7b. Flowers pale rose, 25-35 mm. long, Coquimbo and Conception .....5. **angustifolia Herb.**
        6a. Leaves not grass-like:
          8a. Flowers white-toned:
            9a. Flowers white or slightly rose; 25-45 mm. long. Coquimbo and Talca ....6. **pulchra** Sims
            9b. White, or slightly rose-violet; 50-60 mm. long. Valparaiso, Aconcuga and Catemu ....6a. **pulchra** var. **maxima** R. A. Phil.
          8b. Flowers violet toned:
            10a. Flowers intense lilac colored; Prov. Antofagasta to Coquimbo 6b. **pulcchra** forma **liliacina** Garaventa
            10b. Flowers intense violet colored; Prov. Antofagasta to Coquimbo ....7. **violacea** R. A. Phil.
      5b. Flowers with sharp-pointed mucro; reddish, yellow to orange:
          11a. Flowers reddish, mucro of coffee to red color; Concepcion and Osorno ....8. **ligtu** Linn.
          11b. Flowers yellow to orange:
            12a. Flowers yellow, mucro coffeeish-red; Concepcion and Osorno
            8a. **ligtu** forma **flavens** Garaventa
            12b. Flowers golden yellow to orange; green mucro Concepcion & Aysen 9. **aurantiaca** D. Don
1b. Plants less than 30 cm high; leaves not resupinated:
  13a. Leaves grass-like:

14a. Flowers whitish or pale rose.
Antofagasta and Atacama ....10. **graminea** R. A. Phil.

14b. Flowers yellow:

15a. Internal and outer tepals without stain.
Atacama ....11. **kingii** R. A. Phil.

15b. Internal and outer tepals with stained purple, and violet spots, Colchagua to Linares ....12. **tigrina** R. A. Phil.

13b. Leaves not grass-like:

16a. Leaves non-spatulate, semi-embracingg, tightly "lauced"; flowers yellow, 30-36 mm. long.
Prov. Talca ....13. **crocea** R. A. Phil.

16b. Leaves spatulate:

17a. Leaf margins regular:

18a. Leaves pilous; greenish yellow, stained violet, 12-25 mm. long. Prov. Coquimbo .....14. **venustula** R. A. Phil.

18b. Leaves glabrous:

19a. Flowers pink, 20-25 mm. long.
Prov. Coquimbo ....15. **andina** R. A. Phil.

19b. Flowers white or pale pink, 15-17 mm. long.
Prov. Atacama ....16. **polyphylla** R. A. Phil.

17b. Leaf margins irregular:

20a. Leaf margins slightly wavy, never "cripated" (crisped); flowers intense pink, 25-35 mm. long. Andes of Central Chile and north Chile between provinces of Coquimbo and Curico ....17. **spathulata** Presl

20b. Leaves undulated or with "crispated" margins:

21a. Leaves with margins markedly "crispated". Prov. Coquimbo ....18. **crispata** R. A. Phil.

21b. Leaves with margins undulated; flowers intense yellow. Prov. Aysen and Magellanes
19. **patagonica** R. A. Phil.

PLANT LIFE LIBRARY

AN ILLUSTRATED HISTORY OF GARDENING, by Anthony Huxley. Paddington Press, 95 Madison Av., New York City 10016. 1978. Pp. 352. Illus. $24.95.—One of the outstanding events in the gardening world for 1978 was the publication of Anthony Huxley's monumental **History of Gardening.** The author, the eldest son of Sir Julian Huxley, writer, photographer, lecturer on horticulture, plant science, plant exploration, and travel, has produced a text which will appeal to gardeners generally the world over. The 25 full pages in color illustrations and the additional ones in black and white, are outstanding in quality. The comprehensive text pages are devoted to the origins of gardens; how gardens developed; parts of the garden; instruments of gardening; essential operations; advanced cultivation; plants under cover; the lawn; specialization, and today and tomorrow. A selected bibliography and index complete the volume. Very highly recommended.

TIME LINES, by the Diagram Group. Paddington Press, 95 Madison Av., New York City. 10016. 1978. A series of six booklets (each with 5 to 7 accordion bellows-like page faces between covers) at $2.95 each.—The Diagram Group consists of a team of researchers, illustrators and designers who have now created a number of best-selling booklets in the **Time Lines** series of six: (1) Science and Technology, (2) World History through the

PLANT LIFE LIBRARY—continued on page 42.

THE AMERICAN PLANT LIFE SOCIETY

For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

1. THE AMERICAN AMARYLLIS SOCIETY

[A Committee of the American Plant Life Society]

[AMERICAN AMARYLLIS SOCIETY, continued from page 6.]

(c) REGISTRATION OF PLANT NAMES

Mr. James M. Weinstock, Registrar, 10331 Independence, Chatsworth, Calif. 91311

Correspondence about the registration of plant names should be sent directly to the Registrar, and a self-addressed, stamped envelope should be enclosed if a reply is expected.

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The Chairman and Secretary of the Council also function as Official Instructors.

Examinations.—Those desiring to take the examination for the Official Amaryllis Judges Certificate, should preferably apply to the Official Instructors for details. See Plant Life Vol. 27, 1971, Pickard Study Course, pages 22—27.

All accredited Amaryllis judges of the AMERICAN AMARYLLIS SOCIETY are members of the COUNCIL.

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III. PUBLICATIONS OF THE AMERICAN PLANT LIFE SOCIETY

BOOKS

1. **AMARYLLIDACEAE: TRIBE AMARYLLEAE,** by Traub & Moldenke (including the genera Amaryllis, Lycoris, Worsleya, Lepidopharynx, Placea, Griffinia, and Ungernia; Manila covers; 194 pages, incl. 18 illustrations. $8.00 postpaid.
This is required reading for every amaryllid enthusiast.

2. **DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893—1948,** by Norton, Stuntz, and Ballard. A total of 2695 Hemerocallis clones are included and also an interesting foreword, and explanatory section about naming daylilies. Manila covers; 100 pages (I—X; 1—90), includes a portrait of George Yeld. $5.00 postpaid.

3. **THE GENERA OF AMARYLLIDACEAE**, by Hamilton P. Traub. Includes a general introduction, a key to the subfamilies, infrafamilies, tribes, subtribes and genera of the Amaryllidaceae, and descriptions of all the genera. Every member of the Society should have this book for constant reference. Manila covers; publ. 1963; 85 pages. $8.00 postpaid.

4. **LINEAGICS**, by Hamilton P. Traub. This is the first outline text for the undergraduate student on the grouping of organisms into lineages. The text is divided into four parts: (a) the history of lineagics and lineagics as an integrated science; (b) basic lineagics, principles and procedures; (c) applied lineagics, principles and procedures; and (d) research methods in lineagics. Recommended for the student in biology. Publ. 194. Manila covers, 163 pages, incl. 8 illus. $8.00 postpaid.

PERIODICALS

(A) **HERBERTIA, or AMARYLLIS YEAR BOOK** [**First series,** 1934 to 1948, incl.], devoted exclusively to the amaryllids (Amaryllidaceae), and the workers concerned in their advancement. A complete set of these volumes is indispensable to all who are interested in the amaryllids. Libraries should note that this may be the last opportunity for complete sets.

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(B) **PLANT LIFE**, including numbers on various plant subjects, 1945-1948; thereafter, 1949 to date, various plant subjects, **PLANT LIFE**, and the **AMARYLLIS YEAR BOOK** are combined in a single volume entitled, **PLANT LIFE.**

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Vols. 1—35, (1945-1979), $250.00, postpaid.

Sets of 5 consecutive volumes published after 1979, when completed, may be purchased at $40.00 postpaid, per set.

Single volumes, when available, may be purchased at $10.00 each, postpaid.

Make checks payable to the AMERICAN PLANT LIFE SOCIETY, and send orders to—

Dr. Thomas W. Whitaker, Executive Secretary,
The American Plant Life Society,
Box 150, La Jolla, Calif. 92038